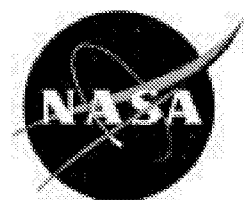


NASA/SP—2000-7011/SUPPL499
APRIL 2000

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



National Aeronautics and
Space Administration
Langley Research Center
**Scientific and Technical
Information Program Office**

The NASA STI Program Office . . . in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA Scientific and Technical Information (STI) Program Office plays a key part in helping NASA maintain this important role.

The NASA STI Program Office is operated by Langley Research Center, the lead center for NASA's scientific and technical information. The NASA STI Program Office provides access to the NASA STI Database, the largest collection of aeronautical and space science STI in the world. The Program Office is also NASA's institutional mechanism for disseminating the results of its research and development activities. These results are published by NASA in the NASA STI Report Series, which includes the following report types:

- **TECHNICAL PUBLICATION.** Reports of completed research or a major significant phase of research that present the results of NASA programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA's counterpart of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.
- **TECHNICAL MEMORANDUM.** Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
- **CONTRACTOR REPORT.** Scientific and technical findings by NASA-sponsored contractors and grantees.

- **CONFERENCE PUBLICATION.** Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or cosponsored by NASA.
- **SPECIAL PUBLICATION.** Scientific, technical, or historical information from NASA programs, projects, and missions, often concerned with subjects having substantial public interest.
- **TECHNICAL TRANSLATION.** English-language translations of foreign scientific and technical material pertinent to NASA's mission.

Specialized services that complement the STI Program Office's diverse offerings include creating custom thesauri, building customized databases, organizing and publishing research results . . . even providing videos.

For more information about the NASA STI Program Office, see the following:

- Access the NASA STI Program Home Page at [*http://www.sti.nasa.gov*](http://www.sti.nasa.gov)
- E-mail your question via the Internet to [*help@sti.nasa.gov*](mailto:help@sti.nasa.gov)
- Fax your question to the NASA STI Help Desk at (301) 621-0134
- Telephone the NASA STI Help Desk at (301) 621-0390
- Write to:
NASA STI Help Desk
NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320

Introduction

This supplemental issue of *Aerospace Medicine and Biology, A Continuing Bibliography with Indexes* (NASA/SP—1999-7011) lists reports, articles, and other documents recently announced in the NASA STI Database.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract.

The NASA CASI price code table, addresses of organizations, and document availability information are included before the abstract section.

Two indexes—subject and author are included after the abstract section.

SCAN Goes Electronic!

If you have electronic mail or if you can access the Internet, you can view biweekly issues of *SCAN* from your desktop absolutely free!

Electronic SCAN takes advantage of computer technology to inform you of the latest worldwide, aerospace-related, scientific and technical information that has been published.

No more waiting while the paper copy is printed and mailed to you. You can view *Electronic SCAN* the same day it is released—up to 191 topics to browse at your leisure. When you locate a publication of interest, you can print the announcement. You can also go back to the *Electronic SCAN* home page and follow the ordering instructions to quickly receive the full document.

Start your access to *Electronic SCAN* today. Over 1,000 announcements of new reports, books, conference proceedings, journal articles...and more—available to your computer every two weeks.

**Timely
Flexible
Complete
FREE!**

For Internet access to *E-SCAN*, use any of the following addresses:

<http://www.sti.nasa.gov>

[ftp.sti.nasa.gov](ftp://sti.nasa.gov)

[gopher.sti.nasa.gov](gopher://sti.nasa.gov)

To receive a free subscription, send e-mail for complete information about the service first. Enter **scan@sti.nasa.gov** on the address line. Leave the subject and message areas blank and send. You will receive a reply in minutes.

Then simply determine the *SCAN* topics you wish to receive and send a second e-mail to **listserv@sti.nasa.gov**. Leave the subject line blank and enter a subscribe command, denoting which topic you want and your name in the message area, formatted as follows:

Subscribe SCAN-02-01 Jane Doe

For additional information, e-mail a message to **help@sti.nasa.gov**.

Phone: (301) 621-0390

Fax: (301) 621-0134

Write: NASA STI Help Desk
NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320

Looking just for *Aerospace Medicine and Biology* reports?

Although hard copy distribution has been discontinued, you can still receive these vital announcements through your *E-SCAN* subscription. Just **Subscribe SCAN-AEROMED Jane Doe** in the message area of your e-mail to **listserv@sti.nasa.gov**.



Table of Contents

Records are arranged in categories 51 through 55, the Life Sciences division of *STAR*. Selecting a category will link you to the collection of records cited in this issue pertaining to that category.

51	Life Sciences (General)	1
52	Aerospace Medicine Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.	17
53	Behavioral Sciences Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.	53
54	Man/System Technology and Life Support Includes human engineering; biotechnology; and space suits and protective clothing.	62

Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also view the indexes provided, for searching on *NASA Thesaurus* subject terms and author names.

Subject Term Index	ST-1
Author Index	PA-1

Selecting an index above will link you to that comprehensive listing.

Document Availability

Select **Availability Info** for important information about NASA Scientific and Technical Information (STI) Program Office products and services, including registration with the NASA Center for Aerospace Information (CASI) for access to the NASA CASI TRS (Technical Report Server), and availability and pricing information for cited documents.

The New NASA Video Catalog is Here

To order your **Free!** copy,
call the NASA STI Help Desk at

(301) 621-0390,

fax to

(301) 621-0134,

e-mail to

help@sti.nasa.gov,

or visit the NASA STI Program

homepage at

<http://www.sti.nasa.gov>

(Select STI Program Bibliographic Announcements)

Explore the Universe!

Document Availability Information

The mission of the NASA Scientific and Technical (STI) Program Office is to quickly, efficiently, and cost-effectively provide the NASA community with desktop access to STI produced by NASA and the world's aerospace industry and academia. In addition, we will provide the aerospace industry, academia, and the taxpayer access to the intellectual scientific and technical output and achievements of NASA.

Eligibility and Registration for NASA STI Products and Services

The NASA STI Program offers a wide variety of products and services to achieve its mission. Your affiliation with NASA determines the level and type of services provided by the NASA STI Program. To assure that appropriate level of services are provided, NASA STI users are requested to register at the NASA Center for AeroSpace Information (CASI). Please contact NASA CASI in one of the following ways:

E-mail: help@sti.nasa.gov
Fax: 301-621-0134
Phone: 301-621-0390
Mail: ATTN: Registration Services
NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320

Limited Reproducibility

In the database citations, a note of limited reproducibility appears if there are factors affecting the reproducibility of more than 20 percent of the document. These factors include faint or broken type, color photographs, black and white photographs, foldouts, dot matrix print, or some other factor that limits the reproducibility of the document. This notation also appears on the microfiche header.

NASA Patents and Patent Applications

Patents and patent applications owned by NASA are announced in the STI Database. Printed copies of patents (which are not microfiched) are available for purchase from the U.S. Patent and Trademark Office.

When ordering patents, the U.S. Patent Number should be used, and payment must be remitted in advance, by money order or check payable to the Commissioner of Patents and Trademarks. Prepaid purchase coupons for ordering are also available from the U.S. Patent and Trademark Office.

NASA patent application specifications are sold in both paper copy and microfiche by the NASA Center for AeroSpace Information (CASI). The document ID number should be used in ordering either paper copy or microfiche from CASI.

The patents and patent applications announced in the STI Database are owned by NASA and are available for royalty-free licensing. Requests for licensing terms and further information should be addressed to:

National Aeronautics and Space Administration
Associate General Counsel for Intellectual Property
Code GP
Washington, DC 20546-0001

Sources for Documents

One or more sources from which a document announced in the STI Database is available to the public is ordinarily given on the last line of the citation. The most commonly indicated sources and their acronyms or abbreviations are listed below, with an Addresses of Organizations list near the back of this section. If the publication is available from a source other than those listed, the publisher and his address will be displayed on the availability line or in combination with the corporate source.

Avail: NASA CASI. Sold by the NASA Center for AeroSpace Information. Prices for hard copy (HC) and microfiche (MF) are indicated by a price code following the letters HC or MF in the citation. Current values are given in the NASA CASI Price Code Table near the end of this section.

Note on Ordering Documents: When ordering publications from NASA CASI, use the document ID number or other report number. It is also advisable to cite the title and other bibliographic identification.

Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy.

Avail: BLL (formerly NLL): British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. Photocopies available from this organization at the price shown. (If none is given, inquiry should be addressed to the BLL.)

Avail: DOE Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of Department of Energy reports, usually in microfiche form, are listed in Energy Research Abstracts. Services available from the DOE and its depositories are described in a booklet, *DOE Technical Information Center—Its Functions and Services* (TID-4660), which may be obtained without charge from the DOE Technical Information Center.

Avail: ESDU. Pricing information on specific data, computer programs, and details on ESDU International topic categories can be obtained from ESDU International.

Avail: Fachinformationszentrum Karlsruhe. Gesellschaft für wissenschaftlich-technische Information mbH 76344 Eggenstein-Leopoldshafen, Germany.

- Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by Pendragon House, Inc. (PHI), Redwood City, CA. The U.S. price (including a service and mailing charge) is given, or a conversion table may be obtained from PHI.
- Avail: Issuing Activity, or Corporate Author, or no indication of availability. Inquiries as to the availability of these documents should be addressed to the organization shown in the citation as the corporate author of the document.
- Avail: NASA Public Document Rooms. Documents so indicated may be examined at or purchased from the National Aeronautics and Space Administration (JBD-4), Public Documents Room (Room 1H23), Washington, DC 20546-0001, or public document rooms located at NASA installations, and the NASA Pasadena Office at the Jet Propulsion Laboratory.
- Avail: NTIS. Sold by the National Technical Information Service. Initially distributed microfiche under the NTIS SRIM (Selected Research in Microfiche) are available. For information concerning this service, consult the NTIS Subscription Section, Springfield, VA 22161.
- Avail: Univ. Microfilms. Documents so indicated are dissertations selected from Dissertation Abstracts and are sold by University Microfilms as xerographic copy (HC) and microfilm. All requests should cite the author and the Order Number as they appear in the citation.
- Avail: US Patent and Trademark Office. Sold by Commissioner of Patents and Trademarks, U.S. Patent and Trademark Office, at the standard price of \$1.50 each, postage free.
- Avail: (US Sales Only). These foreign documents are available to users within the United States from the National Technical Information Service (NTIS). They are available to users outside the United States through the International Nuclear Information Service (INIS) representative in their country, or by applying directly to the issuing organization.
- Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed on the Addresses of Organizations page. The libraries may be queried concerning the availability of specific documents and the possible utilization of local copying services, such as color reproduction.

Addresses of Organizations

British Library Lending Division
Boston Spa, Wetherby, Yorkshire
England

Commissioner of Patents and Trademarks
U.S. Patent and Trademark Office
Washington, DC 20231

Department of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, TN 37830

European Space Agency–
Information Retrieval Service ESRIN
Via Galileo Galilei
00044 Frascati (Rome) Italy

ESDU International
27 Corsham Street
London
N1 6UA
England

Fachinformationszentrum Karlsruhe
Gesellschaft für wissenschaftlich–technische
Information mbH
76344 Eggenstein–Leopoldshafen, Germany

Her Majesty's Stationery Office
P.O. Box 569, S.E. 1
London, England

NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320

(NASA STI Lead Center)
National Aeronautics and Space Administration
Scientific and Technical Information Program Office
Langley Research Center – MS157
Hampton, VA 23681

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

Pendragon House, Inc.
899 Broadway Avenue
Redwood City, CA 94063

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

University Microfilms
A Xerox Company
300 North Zeeb Road
Ann Arbor, MI 48106

University Microfilms, Ltd.
Tylers Green
London, England

U.S. Geological Survey Library National Center
MS 950
12201 Sunrise Valley Drive
Reston, VA 22092

U.S. Geological Survey Library
2255 North Gemini Drive
Flagstaff, AZ 86001

U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025

U.S. Geological Survey Library
Box 25046
Denver Federal Center, MS914
Denver, CO 80225

NASA CASI Price Tables — Effective January 1, 2000

Hardcopy & Microfiche Prices

<i>Code</i>	<i>NASA</i>	<i>U.S.*</i>	<i>International*</i>
A01	\$9.50	\$9.50	\$19.00
A02	\$13.50	\$14.50	\$29.00
A03	\$24.50	\$27.50	\$55.00
A04	\$27.00	\$30.50	\$61.00
A05	\$28.50	\$32.50	\$65.00
A06	\$31.00	\$35.50	\$71.00
A07	\$34.50	\$39.50	\$79.00
A08	\$37.50	\$43.00	\$86.00
A09	\$42.50	\$49.00	\$98.00
A10	\$45.50	\$53.00	\$106.00
A11	\$48.50	\$56.50	\$113.00
A12	\$52.50	\$61.00	\$122.00
A13	\$55.50	\$65.00	\$130.00
A14	\$57.50	\$67.00	\$134.00
A15	\$59.50	\$69.50	\$139.00
A16	\$61.50	\$72.00	\$144.00
A17	\$63.50	\$74.50	\$149.00
A18	\$67.00	\$78.50	\$157.00
A19	\$69.00	\$81.00	\$162.00
A20	\$71.00	\$83.50	\$167.00
A21	\$73.00	\$86.00	\$172.00
A22	\$78.50	\$92.50	\$185.00
A23	\$80.50	\$95.00	\$190.00
A24	\$82.50	\$97.00	\$194.00
A25	\$84.50	\$99.50	\$199.00
A99	Contact NASA CASI		

Exception Prices

<i>Code</i>	<i>NASA</i>	<i>U.S.*</i>	<i>International*</i>
E01	\$102.50	\$121.00	\$242.00
E02	\$111.00	\$131.50	\$263.00
E03	\$120.50	\$143.00	\$286.00
E04	\$130.00	\$154.00	\$308.00
E05	\$139.50	\$165.50	\$331.00
E06	\$148.00	\$176.00	\$352.00
E07	\$157.50	\$187.00	\$374.00
E08	\$167.00	\$198.50	\$397.00
E09	\$175.50	\$209.00	\$418.00
E10	\$185.00	\$220.00	\$440.00
E11	\$194.50	\$231.50	\$463.00
E12	\$202.50	\$241.00	\$482.00
E13	\$212.00	\$252.50	\$505.00
E14	\$221.50	\$264.00	\$528.00
E15	\$231.00	\$275.50	\$551.00
E16	\$239.50	\$285.50	\$571.00
E17	\$249.00	\$297.00	\$594.00
E18	\$258.50	\$308.50	\$617.00
E19	\$267.00	\$318.50	\$637.00
E20	\$276.50	\$330.00	\$660.00
E21	\$286.00	\$341.50	\$683.00
E22	\$294.50	\$351.50	\$703.00
E23	\$304.00	\$363.00	\$726.00
E24	\$313.50	\$374.50	\$749.00
E99	Free	Free	Free

NASA Prices:

For NASA employees and contractors
registered at NASA CASI.

U.S. Prices: *Shipping fees extra

For users located within the U.S.

International Prices: *Shipping fees extra

For users outside the U.S. and international
within the U.S. embassies

Service Fees

Shipping Fees: per item

\$1.50 U.S.
\$9.00 International

Video Shipping Fees: per title

\$3.50 U.S.
\$11.00 International

Express Service Surcharge: per item

One day CASI processing & shipped FedEx or Airmail.
*This charge is in addition to the shipping fee.

\$15.00 U.S.
\$30.00 International

Fax Service Fees: per item up to 30 pages

\$16.50 U.S.
\$24.00 International

NASA CASI Price Tables — Effective January 1, 2000

Video Prices (VHS)

<i>Code</i>	<i>NASA</i>	<i>U.S.*</i>	<i>International*</i>
V01	\$19.50	\$20.00	\$40.00
V02	\$23.50	\$25.00	\$50.00
V03	\$31.50	\$35.00	\$70.00
V04	\$39.50	\$45.00	\$90.00
V05	\$47.50	\$55.00	\$110.00
V06	\$55.50	\$65.00	\$130.00
V07	\$63.50	\$75.00	\$150.00
V08	\$71.50	\$85.00	\$170.00

Video Prices (Betacam SP) NTSC

<i>Code</i>	<i>NASA</i>	<i>U.S.*</i>	<i>International*</i>
B01	\$71.50	\$85.00	\$170.00
B02	\$75.50	\$90.00	\$180.00
B03	\$83.50	\$100.00	\$200.00
B04	\$119.50	\$145.00	\$290.00
B05	\$135.50	\$165.00	\$330.00
B06	\$171.50	\$210.00	\$420.00
B07	\$207.50	\$255.00	\$510.00
B08	\$243.50	\$300.00	\$600.00

Video Prices (Betacam SP) PAL

<i>Code</i>	<i>NASA</i>	<i>U.S.*</i>	<i>International*</i>
B01	\$98.50	\$119.00	\$238.00
B02	\$164.50	\$201.00	\$402.00
B03	\$186.50	\$229.00	\$458.00
B04	\$223.50	\$275.00	\$550.00
B05	\$230.50	\$284.00	\$568.00
B06	\$237.50	\$293.00	\$586.00
B07	\$244.50	\$302.00	\$604.00
B07	\$252.50	\$312.00	\$624.00

CD-ROM Prices

<i>Code</i>	<i>NASA</i>	<i>U.S.*</i>	<i>International*</i>
C01	\$28.00	\$33.00	\$66.00
C02	\$36.50	\$44.00	\$88.00
C03	\$46.50	\$56.00	\$112.00
C04	\$54.00	\$66.00	\$132.00
C05	\$63.00	\$77.00	\$154.00
C06	\$72.00	\$88.00	\$176.00
C07	\$80.50	\$99.00	\$198.00
C08	\$90.50	\$111.00	\$222.00
C09	\$99.00	\$122.00	\$244.00
C10	\$108.00	\$133.00	\$266.00

NASA Prices:

For NASA employees and contractors
registered at NASA CASI.

U.S. Prices: *Shipping fees extra

For users located within the U.S.

International Prices: *Shipping fees extra

For users outside the U.S. and international
within the U.S. embassies

Service Fees

Shipping Fees: per item

\$1.50 U.S.

\$9.00 International

Video Shipping Fees: per title

\$3.50 U.S.

\$11.00 International

Express Service Surcharge: per item

One day CASI processing & shipped FedEx or Airmail.

*This charge is in addition to the shipping fee.

\$15.00 U.S.

\$30.00 International

Fax Service Fees: per item up to 30 pages

\$16.50 U.S.

\$24.00 International

Federal Depository Library Program

In order to provide the general public with greater access to U.S. Government publications, Congress established the Federal Depository Library Program under the Government Printing Office (GPO), with 53 regional depositories responsible for permanent retention of material, inter-library loan, and reference services. At least one copy of nearly every NASA and NASA-sponsored publication, either in printed or microfiche format, is received and retained by the 53 regional depositories. A list of the Federal Regional Depository Libraries, arranged alphabetically by state, appears at the very end of this section. These libraries are not sales outlets. A local library can contact a regional depository to help locate specific reports, or direct contact may be made by an individual.

Public Collection of NASA Documents

An extensive collection of NASA and NASA-sponsored publications is maintained by the British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England for public access. The British Library Lending Division also has available many of the non-NASA publications cited in the STI Database. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents FIZ–Fachinformation Karlsruhe–Bibliographic Service, D-76344 Eggenstein-Leopoldshafen, Germany and TIB–Technische Informationsbibliothek, P.O. Box 60 80, D-30080 Hannover, Germany.

Submitting Documents

All users of this abstract service are urged to forward reports to be considered for announcement in the STI Database. This will aid NASA in its efforts to provide the fullest possible coverage of all scientific and technical publications that might support aeronautics and space research and development. If you have prepared relevant reports (other than those you will transmit to NASA, DOD, or DOE through the usual contract- or grant-reporting channels), please send them for consideration to:

ATTN: Acquisitions Specialist
NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320.

Reprints of journal articles, book chapters, and conference papers are also welcome.

You may specify a particular source to be included in a report announcement if you wish; otherwise the report will be placed on a public sale at the NASA Center for AeroSpace Information. Copyrighted publications will be announced but not distributed or sold.

Federal Regional Depository Libraries

ALABAMA

AUBURN UNIV. AT MONTGOMERY LIBRARY

Documents Dept.
7300 University Dr.
Montgomery, AL 36117-3596
(205) 244-3650 Fax: (205) 244-0678

UNIV. OF ALABAMA

Amelia Gayle Gorgas Library
Govt. Documents
P.O. Box 870266
Tuscaloosa, AL 35487-0266
(205) 348-6046 Fax: (205) 348-0760

ARIZONA

DEPT. OF LIBRARY, ARCHIVES, AND PUBLIC RECORDS

Research Division
Third Floor, State Capitol
1700 West Washington
Phoenix, AZ 85007
(602) 542-3701 Fax: (602) 542-4400

ARKANSAS

ARKANSAS STATE LIBRARY

State Library Service Section
Documents Service Section
One Capitol Mall
Little Rock, AR 72201-1014
(501) 682-2053 Fax: (501) 682-1529

CALIFORNIA

CALIFORNIA STATE LIBRARY

Govt. Publications Section
P.O. Box 942837 - 914 Capitol Mall
Sacramento, CA 94337-0091
(916) 654-0069 Fax: (916) 654-0241

COLORADO

UNIV. OF COLORADO - BOULDER

Libraries - Govt. Publications
Campus Box 184
Boulder, CO 80309-0184
(303) 492-8834 Fax: (303) 492-1881

DENVER PUBLIC LIBRARY

Govt. Publications Dept. BSG
1357 Broadway
Denver, CO 80203-2165
(303) 640-8846 Fax: (303) 640-8817

CONNECTICUT

CONNECTICUT STATE LIBRARY

231 Capitol Avenue
Hartford, CT 06106
(203) 566-4971 Fax: (203) 566-3322

FLORIDA

UNIV. OF FLORIDA LIBRARIES

Documents Dept.
240 Library West
Gainesville, FL 32611-2048
(904) 392-0366 Fax: (904) 392-7251

GEORGIA

UNIV. OF GEORGIA LIBRARIES

Govt. Documents Dept.
Jackson Street
Athens, GA 30602-1645
(706) 542-8949 Fax: (706) 542-4144

HAWAII

UNIV. OF HAWAII

Hamilton Library
Govt. Documents Collection
2550 The Mall
Honolulu, HI 96822
(808) 948-8230 Fax: (808) 956-5968

IDAHO

UNIV. OF IDAHO LIBRARY

Documents Section
Rayburn Street
Moscow, ID 83844-2353
(208) 885-6344 Fax: (208) 885-6817

ILLINOIS

ILLINOIS STATE LIBRARY

Federal Documents Dept.
300 South Second Street
Springfield, IL 62701-1796
(217) 782-7596 Fax: (217) 782-6437

INDIANA

INDIANA STATE LIBRARY

Serials/Documents Section
140 North Senate Avenue
Indianapolis, IN 46204-2296
(317) 232-3679 Fax: (317) 232-3728

IOWA

UNIV. OF IOWA LIBRARIES

Govt. Publications
Washington & Madison Streets
Iowa City, IA 52242-1166
(319) 335-5926 Fax: (319) 335-5900

KANSAS

UNIV. OF KANSAS

Govt. Documents & Maps Library
6001 Malott Hall
Lawrence, KS 66045-2800
(913) 864-4660 Fax: (913) 864-3855

KENTUCKY

UNIV. OF KENTUCKY

King Library South
Govt. Publications/Maps Dept.
Patterson Drive
Lexington, KY 40506-0039
(606) 257-3139 Fax: (606) 257-3139

LOUISIANA

LOUISIANA STATE UNIV.

Middleton Library
Govt. Documents Dept.
Baton Rouge, LA 70803-3312
(504) 388-2570 Fax: (504) 388-6992

LOUISIANA TECHNICAL UNIV.

Prescott Memorial Library
Govt. Documents Dept.
Ruston, LA 71272-0046
(318) 257-4962 Fax: (318) 257-2447

MAINE

UNIV. OF MAINE

Raymond H. Fogler Library
Govt. Documents Dept.
Orono, ME 04469-5729
(207) 581-1673 Fax: (207) 581-1653

MARYLAND

UNIV. OF MARYLAND - COLLEGE PARK

McKeldin Library
Govt. Documents/Maps Unit
College Park, MD 20742
(301) 405-9165 Fax: (301) 314-9416

MASSACHUSETTS

BOSTON PUBLIC LIBRARY

Govt. Documents
666 Boylston Street
Boston, MA 02117-0286
(617) 536-5400, ext. 226
Fax: (617) 536-7758

MICHIGAN

DETROIT PUBLIC LIBRARY

5201 Woodward Avenue
Detroit, MI 48202-4093
(313) 833-1025 Fax: (313) 833-0156

LIBRARY OF MICHIGAN

Govt. Documents Unit
P.O. Box 30007
717 West Allegan Street
Lansing, MI 48909
(517) 373-1300 Fax: (517) 373-3381

MINNESOTA

UNIV. OF MINNESOTA

Govt. Publications
409 Wilson Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 624-5073 Fax: (612) 626-9353

MISSISSIPPI

UNIV. OF MISSISSIPPI

J.D. Williams Library
106 Old Gym Bldg.
University, MS 38677
(601) 232-5857 Fax: (601) 232-7465

MISSOURI

UNIV. OF MISSOURI - COLUMBIA

106B Ellis Library
Govt. Documents Sect.
Columbia, MO 65201-5149
(314) 882-6733 Fax: (314) 882-8044

MONTANA

UNIV. OF MONTANA

Mansfield Library
Documents Division
Missoula, MT 59812-1195
(406) 243-6700 Fax: (406) 243-2060

NEBRASKA

UNIV. OF NEBRASKA - LINCOLN

D.L. Love Memorial Library
Lincoln, NE 68588-0410
(402) 472-2562 Fax: (402) 472-5131

NEVADA

THE UNIV. OF NEVADA LIBRARIES

Business and Govt. Information Center
Reno, NV 89557-0044
(702) 784-6579 Fax: (702) 784-1751

NEW JERSEY

NEWARK PUBLIC LIBRARY

Science Div. - Public Access
P.O. Box 630
Five Washington Street
Newark, NJ 07101-7812
(201) 733-7782 Fax: (201) 733-5648

NEW MEXICO

UNIV. OF NEW MEXICO

General Library
Govt. Information Dept.
Albuquerque, NM 87131-1466
(505) 277-5441 Fax: (505) 277-6019

NEW MEXICO STATE LIBRARY

325 Don Gaspar Avenue
Santa Fe, NM 87503
(505) 827-3824 Fax: (505) 827-3888

NEW YORK

NEW YORK STATE LIBRARY

Cultural Education Center
Documents/Gift & Exchange Section
Empire State Plaza
Albany, NY 12230-0001
(518) 474-5355 Fax: (518) 474-5786

NORTH CAROLINA

UNIV. OF NORTH CAROLINA - CHAPEL HILL

Walter Royal Davis Library
CB 3912, Reference Dept.
Chapel Hill, NC 27514-8890
(919) 962-1151 Fax: (919) 962-4451

NORTH DAKOTA

NORTH DAKOTA STATE UNIV. LIB.

Documents
P.O. Box 5599
Fargo, ND 58105-5599
(701) 237-8886 Fax: (701) 237-7138

UNIV. OF NORTH DAKOTA

Chester Fritz Library
University Station
P.O. Box 9000 - Centennial and University Avenue
Grand Forks, ND 58202-9000
(701) 777-4632 Fax: (701) 777-3319

OHIO

STATE LIBRARY OF OHIO

Documents Dept.
65 South Front Street
Columbus, OH 43215-4163
(614) 644-7051 Fax: (614) 752-9178

OKLAHOMA

OKLAHOMA DEPT. OF LIBRARIES

U.S. Govt. Information Division
200 Northeast 18th Street
Oklahoma City, OK 73105-3298
(405) 521-2502, ext. 253
Fax: (405) 525-7804

OKLAHOMA STATE UNIV.

Edmon Low Library
Stillwater, OK 74078-0375
(405) 744-6546 Fax: (405) 744-5183

OREGON

PORTLAND STATE UNIV.

Branford P. Millar Library
934 Southwest Harrison
Portland, OR 97207-1151
(503) 725-4123 Fax: (503) 725-4524

PENNSYLVANIA

STATE LIBRARY OF PENN.

Govt. Publications Section
116 Walnut & Commonwealth Ave.
Harrisburg, PA 17105-1601
(717) 787-3752 Fax: (717) 783-2070

SOUTH CAROLINA

CLEMSON UNIV.

Robert Muldrow Cooper Library
Public Documents Unit
P.O. Box 343001
Clemson, SC 29634-3001
(803) 656-5174 Fax: (803) 656-3025

UNIV. OF SOUTH CAROLINA

Thomas Cooper Library
Green and Sumter Streets
Columbia, SC 29208
(803) 777-4841 Fax: (803) 777-9503

TENNESSEE

UNIV. OF MEMPHIS LIBRARIES

Govt. Publications Dept.
Memphis, TN 38152-0001
(901) 678-2206 Fax: (901) 678-2511

TEXAS

TEXAS STATE LIBRARY

United States Documents
P.O. Box 12927 - 1201 Brazos
Austin, TX 78701-0001
(512) 463-5455 Fax: (512) 463-5436

TEXAS TECH. UNIV. LIBRARIES

Documents Dept.
Lubbock, TX 79409-0002
(806) 742-2282 Fax: (806) 742-1920

UTAH

UTAH STATE UNIV.

Merrill Library Documents Dept.
Logan, UT 84322-3000
(801) 797-2678 Fax: (801) 797-2677

VIRGINIA

UNIV. OF VIRGINIA

Alderman Library
Govt. Documents
University Ave. & McCormick Rd.
Charlottesville, VA 22903-2498
(804) 824-3133 Fax: (804) 924-4337

WASHINGTON

WASHINGTON STATE LIBRARY

Govt. Publications
P.O. Box 42478
16th and Water Streets
Olympia, WA 98504-2478
(206) 753-4027 Fax: (206) 586-7575

WEST VIRGINIA

WEST VIRGINIA UNIV. LIBRARY

Govt. Documents Section
P.O. Box 6069 - 1549 University Ave.
Morgantown, WV 26506-6069
(304) 293-3051 Fax: (304) 293-6638

WISCONSIN

ST. HIST. SOC. OF WISCONSIN LIBRARY

Govt. Publication Section
816 State Street
Madison, WI 53706
(608) 264-6525 Fax: (608) 264-6520

MILWAUKEE PUBLIC LIBRARY

Documents Division
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 286-3073 Fax: (414) 286-8074

Typical Report Citation and Abstract

- ❶ 19970001126 NASA Langley Research Center, Hampton, VA USA
- ❷ Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes
- ❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
- ❹ Mar. 1996; 130p; In English
- ❺ Contract(s)/Grant(s): RTOP 505-68-70-04
- ❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
- ❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.
- ❽ Author
- ❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
2. Title
3. Author(s) and Affiliation(s)
4. Publication Date
5. Contract/Grant Number(s)
6. Report Number(s); Availability and Price Codes
7. Abstract
8. Abstract Author
9. Subject Terms

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 499)

APRIL 2000

51

LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see categories 52 through 55.

20000028377 Institute of Space Medico-Engineering, Beijing, China

The Effects of Simulated Weightlessness on the Function of Spleen Lymphocytes and the Expression of C-Fos Proto-Onco-gene in Tail-Suspended Mice

Zhang, Hong, Institute of Space Medico-Engineering, China; Hu, Ping, Institute of Space Medico-Engineering, China; Wen, Xiulan, Institute of Space Medico-Engineering, China; Huang, Bin, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 423-424; In Chinese; Copyright Waived; Avail: Issuing Activity

To investigate the effect of simulated weightlessness on proliferation of spleen lymphocyte, production of interleukin-2 and expression of c-fos proto-oncogene in mice. Mice were tail-suspended for 7 or 14 days to simulate the effect of weightlessness; proliferation of lymphocyte was measured by MTT method, production of IL-2 was determined by biological activity and expression of c-fos proto-oncogene was determined by dot blotting. As compared with the control, the proliferation of spleen lymphocyte and the production of IL-2 were significantly decreased in 14 d suspended group, but the expression of c-fos proto-oncogene was increased in both 7d and 14d suspended groups. This result suggested that simulated weightlessness could interfere with the genes regulating the lymphocyte.

Author

Immune Systems; Lymphocytes; Activity (Biology); Weightlessness; Spleen

20000029456 National Space Biomedical Research Inst., Houston, TX USA

National Space Biomedical Research Institute Annual Report, 1 Oct. 1998 - 30 Sep. 1999

Sep. 30, 1999; 350p; In English; See also 20000029457 through 20000029496

Contract(s)/Grant(s): NCC9-58; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

This report summarizes the activities of the National Space Biomedical Research Institute (NSBRI) during FY 1999, the second full year of existence of the NSBRI's research program, and is prepared in accordance with Cooperative Agreement NCC9-58 between NASA's Lyndon B. Johnson Space Center and Baylor College of Medicine (NSBRI). The report consists of progress reports on projects related to the effects of microgravity and space on physiology. The research is broken up in nine areas: (1) Bone loss, (2) Cardiovascular alterations, (3) human performance, (3) immunology, infection and hematology, (4) muscle alterations and atrophy, (5) Neurovestibular adaptation, radiation effects, (6) technology development, and (7) synergy projects. CASI

Aerospace Medicine; University Program; Bioastronautics; Gravitational Physiology; Gravitational Effects; Physiological Effects; Physiological Responses

20000029459 Johns Hopkins Univ., School of Medicine, Baltimore, MD USA

The Effects of Partial Mechanical Loading and Ibandronate on Skeletal Tissues in the Adult Rat Hindquarter Suspension Model for Microgravity

Schultheis, Lester W., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-10 - B-11; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We report initial data from a suspended rat model that quantitatively relates chronic partial weightbearing to bone loss. Chronic partial weightbearing is our simulation of the effect of limited artificial gravity aboard spacecraft or reduced planetary gravity. Preliminary analysis of bone by PQCT, histomorphometry, mechanical testing and biochemistry suggest that chronic exposure to half of Earth gravity is insufficient to prevent severe bone loss. The effect of episodic full weightbearing activity (Earth Gravity) on rats otherwise at 50% weightbearing was also explored. This has similarity to treatment by an Earth G-rated centrifuge on a spacecraft that normally maintained artificial gravity at half of Earth G. Our preliminary evidence, using the above techniques to analyze bone, indicate that 2 hours daily of full weightbearing was insufficient to prevent the bone loss observed in 50% weightbearing animals. The effectiveness of partial weightbearing and episodic full weightbearing as potential countermeasures to bone loss in spaceflight was compared with treatment by ibandronate. Ibandronate, a long-acting potent bisphosphonate proved more effective in preventing bone loss and associated functionality based upon structure than our first efforts at mechanical countermeasures. The effectiveness of ibandronate was notable by each of the testing methods we used to study bone from gross structure and strength to tissue and biochemistry. These results appear to be independent of generalized systemic stress imposed by the suspension paradigm. Preliminary evidence does not suggest that blood levels of vitamin D were affected by our countermeasures. Despite the modest therapeutic benefit of mechanical countermeasures of partial weightbearing and episodic full weightbearing, we know that some appropriate mechanical signal maintains bone mass in Earth gravity. Moreover, the only mechanism that correctly assigns bone mass and strength to oppose regionally specific force applied to bone is mechanical, a process based upon bone strain. Substantial evidence indicates that the specifics of dynamic loading i.e. time-varying forces are critical. Bone strain history is a predictor of the effect that mechanical conditions have on bone structure mass and strength. Using servo-controlled force plates on suspended rats with implanted strain gauges we manipulated impact forces of ambulation in the frequency (Fourier) domain. Our results indicate that high frequency components of impact forces are particularly potent in producing bone strain independent of the magnitude of the peak force or peak energy applied to the leg. Because a servo-system responds to forces produced by the rat's own muscle activity during ambulation, the direction of ground-reaction loads act on bone through the rat's own musculature. This is in distinction to passive vibration of the floor where forces reach bone through the natural filters of soft tissue and joints. Passive vibration may also be effective, but it may or may not increase bone in the appropriate architectural pattern to oppose the forces of normal ambulatory activity. Effectiveness of high frequency mechanical stimulation in producing regional (muscle directed) bone response will be limited by 1. the sensitivity of bone to a particular range of frequencies and 2. the inertia of the muscles, limiting their response to external forces by increasing tension along insertions. We have begun mathematical modeling of normal ambulatory activity. Effectiveness of high frequency mechanical stimulation in producing regional (muscle directed) bone response will be limited by 1. the sensitivity of bone to a particular range of frequencies and 2. the inertia of the muscles, limiting their response to external forces by increasing tension along insertions. We have begun mathematical modeling of the rat forelimb as a transfer function between impact force and bone strain to predict optimal dynamic loading conditions for this system. We plan additional studies of mechanical counter-measures that incorporate improved dynamic loading, features relevant to anticipated evaluation of artificial gravity, exercise regimens and exposure to Martian gravity, The combination of mechanical countermeasures with ibandronate will also be investigated for signs of synergy.

Author

Bone Demineralization; Bones; Dynamic Loads; Mathematical Models; Microgravity; Musculoskeletal System; Physical Exercise; Bioastronautics

20000029464 Johns Hopkins Univ., School of Medicine, Baltimore, MD USA

Rodent Studies of Cardiovascular Deconditioning

Shoukas, Artin A., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-24 - B-25; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Changes in blood pressure can occur for two reasons: 1) A decrease in cardiac output resulting from the altered contractility of the heart or through changes in venous filling pressure via the Frank Starling mechanism or; 2) A change in systemic vascular resistance. The observed changes in cardiac output and blood pressure after long term space flight cannot be entirely explained through changes in contractility or heart rate alone. Therefore, alterations in filling pressure mediated through changes in systemic venous capacitance and arterial resistance function may be important determinants of cardiac output and blood pressure after long term space flight. Our laboratory and previous studies have shown the importance of veno-constriction mediated by the carotid sinus baroreceptor reflex system on overall circulatory homeostasis and in the regulation of cardiac output. Our proposed experiments test the overall hypothesis that alterations in venous capacitance function and arterial resistance by the carotid sinus baroreceptor reflex system are an important determinant of the cardiac output and blood pressure response seen in astronauts after returning to earth from long term exposure to microgravity. This hypothesis is important to our overall understanding of circulatory adjustments made during long term space flight. It also provides a framework for investigating counter measures to reduce the incidence of orthostatic hypotension caused by an attenuation of cardiac output. We continue to use hind limb unweighted

(HLU) rat model to simulate the patho physiological effects as they relate to cardiovascular deconditioning in microgravity. We have used this model to address the hypothesis that microgravity induced cardiovascular deconditioning results in impaired vascular responses and that these impaired vascular responses result from abnormal alpha-1 AR signaling. The impaired vascular reactivity results in attenuated blood pressure and cardiac output responses to an orthostatic challenge. We have used in vitro vascular reactivity assays to explore abnormalities in vascular responses in vessels from HLU animals and, cardiac output (CO), blood pressure (BP) and heart rate (HR) measurements to characterize changes in hemodynamics following HLU.

Author

Blood Pressure; Cardiovascular System; Carotid Sinus Reflex; Heart; Heart Rate; Hemodynamic Responses; Microgravity; Physiological Effects; Physiological Responses; Bioastronautics

20000029496 Johns Hopkins Univ., Oncology Center, Baltimore, MD USA

Chemoprevention of Radiation Induced Rat Mammary Neoplasms

Huso, David L., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-97 - B-98; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Radiations encountered in space include protons and heavy ions such as iron as well as their secondaries. The relative biological effect (RBE) of these ions is not known, particularly at the doses and dose-rates expected for planetary missions. Neutrons, are not particularly relevant to space travel, but have been found experimentally to have an increase in their RBE with decreasing dose. If a similar trend of increasing RBE with decreasing dose is present for heavy ions and protons during irradiation in space, the small doses received during space travel could potentially have substantial carcinogenic risk. Clearly more investigation of the effects of heavy ions and protons is needed before accurate risk assessment for prolonged travel in space can be done. One means to mitigate the increased risk of cancer due to radiation exposure in space is by developing effective countermeasures that can reduce the incidence of tumor development. Tamoxifen has recently been shown to be an effective chemopreventive agent in both animal models and humans for the prevention of mammary tumors. Tamoxifen is a unique drug, with a highly specific mechanism of action affecting a specific radiation-sensitive population of epithelial cells in the mammary gland. In human studies, the annual incidence of a primary tumor in the contralateral breast of women with previous breast cancer is about 8 per 1000, making them an exceedingly high-risk group for the development of breast cancer. In this high risk group, treated with tamoxifen, daily, for 2 years, the incidence of a new primary tumor in the contralateral breast was approximately one third of that noted in the non-tamoxifen treatment group. Tamoxifen antagonizes the action of estrogen by competing for the nuclear receptor complex thereby altering the association of the receptor complex and nuclear binding sites. Its effects in reducing the development of breast cancer could be accomplished by controlling clinically undetectable microcancers, arresting preneoplastic lesions, or correcting abnormal environments which predispose to high risk of malignant transformation.

Derived from text

Cancer; Carcinogens; Mammary Glands; Prevention; Radiation Effects; Relative Biological Effectiveness (RBE); Tumors; Neoplasms; Health Physics; Aerospace Medicine

20000029587 Chinese Academy of Medical Sciences, Beijing, China

Development and Prospect of Plant Mutation Breeding Induced by Aviation and Spaceflight in China

Li, Jin-gou, Chinese Academy of Medical Sciences, China; Wang, Pei-sheng, Chinese Academy of Medical Sciences, China; Zhang, Jian, Chinese Academy of Medical Sciences, China; Jiang, Xing-cun, Chinese Academy of Medical Sciences, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 464-468; In Chinese; Copyright; Avail: Issuing Activity

Since 1987, about fifty species and three hundred varieties of crops have been sent in recoverable satellites or high altitude balloon (HAB). The selected lines include a high-yield, disease-resistant, and hybrid-vigorous rice line, a recovered line of Japonica rice restoring sterility of Indica rice, a new green pepper strain which grows fruits over 500 g, a disease-resistant, high-quality tomato line, a big-pod rape line, a big-fruit white lotus line and a big-bulb lily. The special conditions in outer space can induce a variety of mutations in the plants and their progeny, which provides a new way for the plant breeding.

Author

Breeding (Reproduction); Farm Crops; Mutations; Space Flight; Mutagens; Plants (Botany); Botany

20000029599 National Bioethics Advisory Commission, Rockville, MD USA

Research Involving Human Biological Materials: Ethical Issues and Policy Guidance, Volume 1, Report and Recommendations of the National Bioethics Advisory Commission

Aug. 1999; 140p; In English

Report No.(s): PB2000-102936; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

Contents include the following: Letter of Transmittal to the President; National Bioethics Advisory Commission; National Bioethics Advisory Commission Staff and Consultants; Executive Summary; Overview and Introduction; Collection, Storage, and Use of Human Biological Materials in the USA; Current Guidance on the Use of Human Biological Materials in Research; Ethical Perspectives on the Research Use of Human Biological Materials; Conclusions and Recommendations; Appendix A: Beliefs About the Research Use of Human Biological Materials; Appendix B: Code of Federal Regulations, Title 45, Part 46; Appendix C: Comparison Table of Professional Statements; Appendix D: Guidance for Institutional Review Boards Reviewing Research Using Human Biological Materials; Appendix E: Public Comments on NBAC's February 22, 1999 Draft; Appendix F: Public and Expert Testimony; and Appendix G: Commissioned Papers.

NTIS

Genetic Engineering; Research Management; Medical Science

20000029606 Institute of Space Medico-Engineering, Beijing, China

Immunoblotting Observation on Changes of Myosin Degradation Metabolism in Toad Gastrocnemius Muscle Electric Simulation Under Simulated Exercise Load

Ni, Cheng-zhi, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 426-430; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study was to probe into the optimum exercise load in sports training. Myosin heavy chain degradation fragments produced by different-intensity electric stimulation were identified in toad gastrocnemius muscle. The fragments were identified by electrophoresis of unfractionated extracts of toad gastrocnemius muscle on sodium dodecyl sulfate/polyacrylamide gels followed by immunoblotting on nitrocellulose sheets. Polyclonal antibody directed against the entire myosin were used to characterize the fragments. Toad gastrocnemius muscle protein degradation increased under high-intensity electric stimulation; two kinds of Myosin degradation fragments whose molecular weight were 43KD and 38KD respectively were produced by double high-intensity electric stimulation; the molecular weight 43KD immunoreactive myosin fragments produced by high-intensity electric stimulation disappeared under low-intensity electric stimulation. Continuous high-intensity exercise load would make muscle contractile protein further degrade while low-intensity exercise load would enhance the recover of contraction and function of the muscle.

Author

Cellulose Nitrate; Physical Exercise; Proteins; Stimulation; Metabolism

20000029607 Institute of Aviation Medicine, Beijing, China

Effects of Simulated Flight Hypobaric Hypoxia and Oxygen Inhalation on Free Radical Metabolism

Zhang, Qing-jun, Institute of Aviation Medicine, China; Zhan, Hao, Institute of Aviation Medicine, China; Li, Tong, Institute of Aviation Medicine, China; Hao, Ai-gong, Institute of Aviation Medicine, China; Wan, Chang-hong, Institute of Aviation Medicine, China; Xin, Yi-mei, Institute of Aviation Medicine, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 414-416; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study was to investigate the effects of two types of simulated flight conditions (hypobaric hypoxia and hypobaric oxygen inhalation) on free radical metabolism in various organs of mice. Sixty male Kunming mice were randomly divided into six groups (n=10 each). The experiment was comprised of two parts. The first part included three groups: normal controls (A1), 1500 m hypobaric hypoxia for 4 wk (B1) and 8 wk (C1). The second part included another three groups: normal control (A2), 5500 m hypobaric oxygen inhalation for 4 wk (B2) and 8 wk (C2). The exposure time in hypobaric chamber was 2 h/d, 3 d/wk. After the experiment, caudal blood was taken for routine examination. The mice were decapitated on the next day and brain, heart, lung, liver and kidney homogenates were prepared for measuring malondialdehyde(MDA) content and superoxide dismutase (SOD) activity. Lipid peroxides in the lungs were significantly increased in C1 group, and the content of myocardial MDA and myocardial SOD activities in C2 group were markedly higher than those in A2 group. There were no significant differences among body weights, mean corpuscular indices and hemoglobin content in the normal control, hypobaric hypoxia and hypobaric oxygen inhalation groups. It demonstrates that repeated mild hypobaric hypoxia for 8 wk causes free radical damage in the lung and repeated exposure to 5500 m hypobaric oxygen inhalation for 8 wk may lead to myocardial peroxidative injury in mice. Simulated flight hypobaric hypoxia and oxygen inhalation may lead to free radicals damage of lung and myocardial peroxidative injury in mice.

Author

Damage; Hypobaric Atmospheres; Hypoxia; Lungs; Metabolism; Respiration

20000030739 NASA Lewis Research Center, Cleveland, OH USA

Method for Fabricating Soft Tissue Implants with Microscopic Surface Roughness

Banks, Bruce A., Inventor, NASA Lewis Research Center, USA; Rutledge, Sharon K., Inventor, NASA Lewis Research Center, USA; Oct. 12, 1999; 16p; In English

Patent Info.: Filed 22 Sep. 1997; NASA-Case-LEW-15805-1; US-Patent-5,965,076; US-Patent-Appl-SN-936492; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A method for fabricating soft tissue implants using a mold. The cavity surface of an initially untextured mold, made of an organic material such as epoxy, is given a thin film coating of material that has pinholes and is resistant to atomic particle bombardment. The mold cavity surface is then subjected to atomic particle bombardment, such as when placed in an isotropic atomic oxygen environment. Microscopic depressions in the mold cavity surface are created at the pinhole sites on the thin film coating. The thin film coating is removed and the mold is then used to cast the soft tissue implant. The thin film coating having pinholes may be created by chilling the mold below the dew point such that water vapor condenses upon it; distributing particles, that can partially dissolve and become attached to the mold cavity surface, onto the mold cavity surface; removing the layer of condensate, such as by evaporation; applying the thin film coating over the entire mold surface; and, finally removing the particles, such as by dissolving or brushing it off. Pinholes are created in the thin film coating at the sites previously occupied by the particles.

Official Gazette of the U.S. Patent and Trademark Office

Fabrication; Procedures; Technology Assessment; Softness; Tissues (Biology); Implantation; Organic Materials; Surface Roughness; Thin Films

20000031601 NASA Ames Research Center, Moffett Field, CA USA

Membrane-Based Functions in the Origin of Cellular Life *Final Report, 1 Oct. 1995 - 31 Mar. 1999*

Chipot, Christophe, Universite Henri-Poincare, France; New, Michael H., California Univ., USA; Schweighofer, Karl, NASA Ames Research Center, USA; Pohorille, Andrew, NASA Ames Research Center, USA; Wilson, Michael A., NASA Ames Research Center, USA; [1999]; 27p; In English

Contract(s)/Grant(s): NCC2-772; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Our objective is to help explain how the earliest ancestors of contemporary cells (protocells) performed their essential functions employing only the molecules available in the protobiological milieu. Our hypothesis is that vesicles, built of amphiphilic, membrane-forming materials, emerged early in protobiological evolution and served as precursors to protocells. We further assume that the cellular functions associated with contemporary membranes, such as capturing and transducing of energy, signaling, or sequestering organic molecules and ions, evolved in these membrane environments. An alternative hypothesis is that these functions evolved in different environments and were incorporated into membrane-bound structures at some later stage of evolution. We focus on the application of the fundamental principles of physics and chemistry to determine how they apply to the formation of a primitive, functional cell. Rather than attempting to develop specific models for cellular functions and to identify the origin of the molecules which perform these functions, our goal is to define the structural and energetic conditions that any successful model must fulfill, therefore providing physico-chemical boundaries for these models. We do this by carrying out large-scale, molecular level computer simulations on systems of interest. Specific systems that we have investigated are: 1. Simulations of water-membrane systems to yield an accurate description of the electrical properties of the membranes. This was investigated by calculating the surface potentials of aqueous interfaces and the interaction of a number of small polar and nonpolar solute molecules with several membrane interfaces. 2. Simulations of ion transport across a water-membrane interface to investigate how "thinning" defects in the membrane effectively increase the permeability of the membrane by several orders of magnitude over predictions based on simple, dielectric continuum models. Simulations of small peptides at the water-hexane interface to investigate how the interface affects the structure of the peptide, and in particular if short peptides, which are disordered in water, can fold into ordered structures at the interface.

Author

Biological Evolution; Cells (Biology); Computerized Simulation; Continuum Modeling; Membrane Structures; Protobiology

20000031618 NASA Langley Research Center, Hampton, VA USA

Method of and Apparatus for Histological Human Tissue Characterization Using Ultrasound

Yost, William T., Inventor, NASA Langley Research Center, USA; Cantrell, John H., Inventor, NASA Langley Research Center, USA; TalEr, George A., Inventor, NASA Langley Research Center, USA; Dec. 28, 1999; 10p; In English; Continuation of US-Patent-Appl-SN-592833, filed 26 Jan. 1996

Patent Info.: Filed 21 Apr. 1998; NASA-Case-LAR-15040-2; US-Patent-6,007,489; US-Patent-Appl-SN-071452; US-Patent-Appl-SN-592833; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A method and apparatus for determining important histological characteristics of tissue, including a determination of the tissue's health. Electrical pulses are converted into meaningful numerical representations through the use of Fourier Transforms. These numerical representations are then used to determine important histological characteristics of tissue. This novel invention does not require rectification and thus provides for detailed information from the ultrasonic scan.

Author

Inventions; Patents; Histology; Tissues (Biology); Health

20000031641 Purdue Univ., Dept. of Earth and Atmospheric Sciences, West Lafayette, IN USA

Biosynthesis of 3-Dimethylsulfoniopropionate in Marine Algae *Final Report, 1 Jan 1996-30 May 1999*

Rhodes, David; Feb. 04, 2000; 45p; In English

Contract(s)/Grant(s): N00014-96-1-0366

Report No.(s): AD-A373466; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To participate in a 4-investigator collaboration (Hanson, Gage, Leustek, Rhodes) to elucidate the pathway of 3-dimethylsulfoniopropionate (DMSP) in marine algae, including identification of intermediates and enzymes of the pathway in the macroalgae *Enteromorpha Intestinalis*, and three diverse marine phytoplankton species; *Tetraselmis* sp., *Melosira Nummuloides*, and *Emiliania Huxleyi*. Develop quantitative models describing flux of through the pathway and its competing branches, and investigate regulation of the pathway.

DTIC

Marine Biology; Algae; Phytoplankton; Biosynthesis

20000031652 Naval Postgraduate School, Monterey, CA USA

A Biologically Based Approach to the Mutation of Code

Vandenberg, Loretta L.; Sep. 1999; 165p; In English

Report No.(s): AD-A373187; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Evolutionary programming is a relatively new problem solving approach in the field of computer science. It attempts to model the processes of natural selection and evolution to solve complex problems. This technique is very powerful because it can be applied to a wide range of problems, and can find solutions that other more traditional techniques cannot. This research attempts to augment the methodology of an evolutionary programming approach with two new features: (1) dominant and recessive traits and (2) intron and exon regions. These features form the basis of a specialized approach for evolutionary programming which might be able to be applied to new problem areas where evolutionary programming usually performs poorly. This specialized approach is applied to the well known problem of a series expansion, so that the results are easily * compared to a known solution, and that the influence of these additional mechanisms on the population of solutions can be studied. Results from implementing the new mechanisms individually and together are presented, and compared with a baseline evolutionary programming implementation.

DTIC

Computer Programming; Mutations; Populations; Series Expansion

20000031697 Fourth Military Medical Univ., Dept. of Aerospace Physiology, Xi'an, China

Effects of Simulated Weightlessness on Vasoreactivity of Hindlimb Arterial Bed in Rats

Ma, Jin, Fourth Military Medical Univ., China; Zhang, Le-ning, Fourth Military Medical Univ., China; Zhang, Li-fan, Fourth Military Medical Univ., China; Yang, Tian-de, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume12, No. 4, pp. 254-257; In Chinese; Copyright; Avail: Issuing Activity

To investigate the alterations in vasoreactivity of hindlimb arterial bed after simulated weightlessness. The tail-suspended rat model was used to simulate weightlessness, and the alterations in vasoreactivity of arterial bed were examined in vitro using isolated, constant flow perfused hindlimb of 2-wk suspended rats and control rats. Perfusion flow-pressure relationship of hindlimb arterial bed showed no significant differences between suspended rats and control rats; but vascular responses to KCl(20 approx. 100 mM) and PE(10(exp -8) - 10(exp -4) M) were decreased in hindlimb arterial bed of suspended rats as compared with that of control rats. Contractile ability of resistance vessels was diminished in simulated weightlessness rats, and a compromised ability of resistance vessels to increase peripheral resistance may play an important role in occurrence of orthostatic intolerance.

Author

Cardiovascular System; Arteries; Weightlessness Simulation

20000031698 Fourth Military Medical Univ., Dept. of Aerospace Physiology, Xi'an, China

Ultrastructural Changes of Arterial Wall from Different Body Parts of Rats During Simulated Weightlessness

Mao, Qin-wen, Fourth Military Medical Univ., China; Zhang, Li-fan, Fourth Military Medical Univ., China; Zhang, Le-ning, Fourth Military Medical Univ., China; Ma, Jin, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 249-253; In Chinese; Copyright; Avail: Issuing Activity

To test the nature of remodeling of arteries in different body parts in adapting to local hemodynamic changes induced by tail-suspension. Ultrastructural changes of hindlimb and cerebral arteries from 4-wk tail-guspended (SUS-4), 1-wk recovered, (REC-1), and control (CON) rats were studied by transmission electron microscopy. For the hindquarter arteries, like the femoral artery and anterior tibial artery, there were fewer smooth muscle layers, less myofilaments the smooth muscle cell (SMC), and more intercellular substance in SUS-4 group than in CON group. After 1-wk recovery, the internal elastic lamina of the arteries thickened, the amount of myofilaments in SMC increased, the content of intercellular substance restored, and neoformative SMCs emerged under the endothelium. With respect to arteries in the neck region and the brain, like the common carotid artery and basilar artery, SMCs of contractile phenotype were converted to that of synthetic phenotype, and migration and hyperplasia of SMCs also happened. After 1-wk recovery all these alterations were somewhat restored. It provided further evidence that peripheral effector mechanism might play an important role in the genesis of postflight orthostatic intolerance.

Author

Arteries; Walls; Cerebrum; Hemodynamic Responses; Weightlessness Simulation

20000031699 Institute of Radiation Medicine, Beijing, China

Heavy Ion Radiation Induced Inactivation of Human Bronchial Epithelial Cells

Yuan, Xiong, Institute of Radiation Medicine, China; Ye, Chang-qing, Institute of Radiation Medicine, China; Yang, Mei-ying, Institute of Radiation Medicine, China; Liu, Lei-hua, Institute of Radiation Medicine, China; Lu, Xiu-qin, Institute of Radiation Medicine, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 240-244; In Chinese; Copyright; Avail: Issuing Activity

The objective is to observe the cell inactivating effects of Li, C and F ions. Li(Z = 3), C (Z = 6) and F(Z = 9) ion beams, with LETs of 100 keV/micron, 300 keV/micron and 1000 keV/micron, respectively were produced by HI-13 tandem accelerator at the Department of Nuclear Physics, China Institute of Atomic Energy. The human bronchial epithelium cell line(BEAS - 2B) was irradiated with the designed doses ranging from 0.5 Gy to 6.0 Gy. After irradiation, the cells were cultured at 1000/flask and the survival fractions were calculated. The cell survival fraction (SF non-unit) have negative exponential relations with dose (D, Gy) as shown by the fitted equations: $SF = \exp(-D/1.28)$ (Li); $SF = \exp(-D/1.19)$ (C); $SF = \exp(-D/2.09)$ (F), respectively. The sensitive parameters (D_0 , Gy) of radiation were $D_0 = 1.28$; $D_0 = 1.18$; $D_0 = 2.09$, respectively. The patterns of cell survival were fitted to single target model. The relative biological effectiveness (RBE) for Li, C and F ions were 2.54, 2.67, 1.55, respectively, compared with D_0 of gamma-ray irradiation. The inactivation cross sections for these ions were 12.5, 40.6 and 76.5 sq microns respectively. The effectiveness of radiation induced by heavy ions of Li, C and F was more serious than that of Co-60 gamma-ray, and more than one particle traversal are needed to kill a cell on the average.

Author

Heavy Ions; Irradiation; Bronchi; Cells (Biology); Epithelium; Relative Biological Effectiveness (RBE); Gamma Rays; Dosage

20000031750 Institute of Space Medico-Engineering, Beijing, China

A Feasibility Study on the Highly-Efficient Electronic Fluorescent Lamp Used as a Lighting Source for Cultivation of Higher Plant in Space

Guo, Shuang-sheng, Institute of Space Medico-Engineering, China; Xu, Bo, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 293-297; In Chinese; Copyright; Avail: Issuing Activity

To testify that the Highly-efficient Electronic Fluorescent Lamp (HEFL) can be used as a sole lighting source for the cultivation of higher plants in space. The HEFL was utilized as the lighting source for the culture of three varieties of *Lactuca sativa* L in the lately-constructed Space Higher Plant Cultivation Ground-based Experimental Facility(SHPCGEF). Other culturing conditions were: temperature 20 ± 0.2 C, relative humidity (75 \pm 1)%, average photosynthetic active radiation (PAR) 70 micro mol/sq m s PPF, average wind velocity 0.45 m/s, photoperiod 24 h light/0 dark, peat + vermiculite substrate culture, useful growing area 1.2 sq m, growing period 28 d, one variety was cultured at every batch. Following plant maturing and being harvested, observations of external morphology of above-ground parts of the plants, measurements and calculations of edible biomass output and photosynthetic efficiency, analysis of nutrient compositions such as proteins, fats, carbon-hydrates, amino acids, vitamins and elemental compositions of lettuce leaves, and comparisons with formerly-related experiments were made. All of the above-mentioned targets met our demands, some of them were superior to the results of other similar experiments. The HEFL can completely

meet the needs for the growth and development of some higher plants planned to be grown in space, its physical characters basically accord with the demands, so it can be utilized as the only lighting source for higher plant growth in space environmental conditions.

Author

Feasibility Analysis; Fluorescence; Biomass; Controlled Atmospheres; Cultivation; Growth; Morphology; Vegetation Growth

20000031751 Institute of Space Medico-Engineering, Beijing, China

Protective Effect of RenShen Compound and DanHuang Compound on Muscle Atrophy in Suspended Rats

Ma, Yong-lie, Institute of Space Medico-Engineering, China; Sun, Ya-zhi, Institute of Space Medico-Engineering, China; Yang, Hong-hui, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 281-283; In Chinese; Copyright; Avail: Issuing Activity

To study the protective effect of RenShen compound and DanHuang compound on muscle atrophy caused by simulated weightlessness in rats. Percentage and cross sectional area of fibers and ultrastructure of soleus(SOL) and gastrocnemius(GAS) were determined in 30 d tail suspended rats with or without administration of the medicine. The percentage of type I fiber of SOL in RenShen(RS) group and DanHuang(DH) group increased by (13.5 +/- 0.96) % (P less than 0.05) and (11.2 +/- 0.84) % (P less than 0.05) respectively, and those of GAS showed only an increasing trend as compared with suspension control(SC). Cross sectional area of muscle fibers of SOL and GAS in both groups increased, especially in RS group(P less than 0.05). The construction of SOL sarcomere in RS and DH groups was improved as compared with SC. RS and DH compounds can partially prevent muscle atrophy caused by tail suspension.

Author

Weightlessness Simulation; Rats; Muscles; Atrophy

20000031754 Institute of Space Medico-Engineering, Beijing, China

Changes of Blood Circulation, Muscle and Skeletal Systems in 30 d Tail-Suspended Rats

Shen, Xian-yun, Institute of Space Medico-Engineering, China; Cui, Wei, Institute of Space Medico-Engineering, China; Ma, Yong-lie, Institute of Space Medico-Engineering, China; Dong, Qi, Institute of Space Medico-Engineering, China; Wang, Tao, Institute of Space Medico-Engineering, China; Yang, Guang-hua, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 277-280; In Chinese; Copyright; Avail: Issuing Activity

To confirm the tail-suspended rat model for the study of countermeasures against weightlessness. The changes of blood circulation, muscle and skeletal systems in control group rats (n = 15) and 30 d tail-suspended rats (n = 15) were compared. Compared with the control group, the hemorrheology and erythrocyte deformability decreased significantly, muscle-fiber atrophy, muscle contraction function decreased, the type I muscle fibers transformed to the type II muscle fibers, bone-mineral content of L3 and load capacity of femur declined, bone metabolism changed in the suspended rats. The tail-suspended rat is a suitable animal model for the study of countermeasures against weightlessness.

Author

Blood Circulation; Bone Mineral Content; Muscular Function; Musculoskeletal System; Rats; Weightlessness Simulation

20000031755 Air Force Medical Coll., Jilin, China

Changes of Serum Biochemical Parameters During Hypothermia and Hypoxia in Rats

Mei, Dan, Air Force Medical Coll., China; Xu, Bin, Air Force Medical Coll., China; Sun, Kui, Air Force Medical Coll., China; Wang, Li-hua, Air Force Medical Coll., China; Zhang, Wei, Air Force Medical Coll., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 274-276; In Chinese; Copyright; Avail: Issuing Activity

To study the effects of hypothermia and hypoxia on serum biochemical parameters. Acute hypobaric hypoxia experiment in cold environment was carried out in 48 healthy Wistar rats to observe changes of hepatic, cardiac and renal functions. Hepatic, cardiac and renal functions changed non-prominently after acute hypoxia exposure under cold condition. Under hypoxic exposure of the same degree, serum lactic dehydrogenase (LDH), alanine transaminase (ALT), blood urea nitrogen (BUN) and creatinine(Cr) increased more significantly at 10 C than those at 20 C (P less than 0.01) while creatine kinase (CK) decreased significantly at 10 C than that at 20 C. After acute hypoxia in cold environment, the changes in cardiac function did not simply equal to the changes by cold environment plus changes by acute hypoxia.

Author

Serums; Biochemistry; Hypothermia; Hypoxia; Rats

20000031756 Academy of Military Medical Sciences, Inst. of Hygiene and Environmental Medicine, Beijing, China

Effects of Acute Hypoxia and Hypoxic Acclimatization on Cardiac Functions of Rats

Long, Chao-liang, Academy of Military Medical Sciences, China; Yin, Zhao-yun, Academy of Military Medical Sciences, China; Sun, Xing-bin, Academy of Military Medical Sciences, China; Zhou, Zhi, Academy of Military Medical Sciences, China; Lu, Xing-qiang, Academy of Military Medical Sciences, China; Wang, Hai, Academy of Military Medical Sciences, China; Space Medicine and Medical Engineering; August 1999; issn 1002-0837; Volume 12, No. 4, pp. 267-269; In Chinese; Copyright; Avail: Issuing Activity

To study the effects of acute hypoxia and intermittent hypoxic acclimatization on cardiac systolic and diastolic functions in rats. Cardiac functions were investigated after intermittent hypoxic acclimatized (3000 m and 5000 in, 2 wk respectively, 4 h/d) and normoxic rats were exposed to hypoxia (8000 m) for 4 h. The systolic functional parameters such as LVSP, + dP/dt(sub max), V(sub pm), V(sub max) and the diastolic functional parameter - dp/dt(sub max) of acute hypoxic rats were reduced significantly as compared with normoxic control rats. After hypoxic acclimatization, the left ventricular functions of rats were increased significantly as compared with those of acute hypoxic rats. But they were still lower than those of normoxic control rats. Acute hypoxia can affect cardiac functions and hypoxic acclimatization can alleviate the hypoxic effects on cardiac functions.

Author

Hypoxia; Acclimatization; Heart Function; Rats

20000031926 Academia Sinica, Inst. of Genetics, Beijing, China

Studies on Hereditary Variations of Millet Seed after High Altitude Balloon Flight

Li, Jin-Guo, Academia Sinica, China; Jiang, Guo-Yong, Academia Sinica, China; Wang, Pei-Sheng, Academia Sinica, China; Zhang, Jian, Academia Sinica, China; Jiang, Xing-Cun, Academia Sinica, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 346-350; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to select high yield, high protein and fatty acid millet. Air-dried seeds of millet were carried by high altitude balloon (HAB) for 8 h. Botany characteristics of these seeds were analyzed and studied after recovery. Germinating potential rose 21.1%, germinating percentage reduced 5.2% as compared with the control; plant height was 6.8 cm lower than that of the control in SP1; while flag-leaf area and spike weight were 25% and 15.9% higher than those of the control respectively. Large-spike strains were stable in SP3 progeny. In SP3(-2), the contents of seed protein and fatty acid were more than those of control; in SP3(-5), the average spike length was 5.8 cm, and the content of Fe element in seed was 61.5 mg/kg more than these of control; in SP4 superspike strains, spike character, chlorophyll content and photosynthetic rate were significantly higher than the control during growing phase and growing anaphase, photosynthetic rate in flag-leaf was over 27.9% higher than those in the control. New strains with high protein and fatty acid and high yield could be selected by HAB. The characteristics of these variations in the new strain is hereditary.

Author

Millet; Seeds; Heredity; Variations

20000031935 Air Force General Hospital, Molecular Biology Research Center, Beijing, China

Expression of HSP70 Gene in Rat Brain after Exposures to Repeated +Gz

Cai, Qing, Air Force General Hospital, China; Liu, Hong-Jin, Air Force General Hospital, China; Chen, You-Chun, Air Force General Hospital, China; Ji, Gui-Ying, Air Force General Hospital, China; Chen, Tong-Xin, Air Force General Hospital, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 313-317; In English

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to study the changes of mRNA expression of heat shock protein 70 (HSP70) in the rat brain exposed to repeated +Gz. The mRNA expression levels of HSP70 in rat brain were measured by semi-quantitative reverse transcription polymerase chain reaction (RT - PCR). The HSP70 mRNA expression levels in rat brains taken 30 min and 6 h after repeated +Gz exposures were significantly higher than those in control group, while the difference between the levels of control group and those of experimental rat brains taken 24 h after +Gz exposure was not significant. It is suggested that HSP70 mRNA expression in rat brain can be induced by repeated +Gz exposures and the increased HSP70 mRNA expression may play an important role in self-protection against brain damage induced by +Gz exposures.

Author

Brain Damage; Exposure; Gene Expression; Thermal Shock; Proteins

20000031966 Academia Sinica, Inst. of Genetics, Beijing, China

A Study on the Ultrastructure of Plant Cell Under Simulated Microgravity

Liu, Min, Academia Sinica, China; Wang, Ya-Lin, Academia Sinica, China; Xue, Huai, Academia Sinica, China; Zhang, Chun-Hua, Academia Sinica, China; Li, She-Rong, Academia Sinica, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 360-363; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to study the effects of microgravity on plant cell ultrastructure. Analyzing the biological and physiological differences between the plants grown in the simulated microgravity conditions and their correspondent ground controls. Various variances in cell walls, chloroplasts and mitochondria were observed with electron microscope. Those ultrastructure changes included plasmolysis, twist, contraction and deformation of cell walls, curvature and loose arrangement of chloroplast lamellae, breach of mitochondria, overflow of inclusions, disappearance of cristae, and significant increase in number of starch grains per cell. Simulated microgravity conditions exert some coerce influence on the plant growth and the changes above-mentioned were the responses in cell level.

Author

Cells (Biology); Plants (Botany); Microgravity

20000031975 Institute of Space Medico-Engineering, Beijing, China

Effects of Low Concentration Carbon Monoxide on the Neurobehavior Function in Mice

Liang, Hong, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 318-322; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to study the effect of low concentration CO on neurobehavior function and the maximal allowable concentration (MAC) in limited time. 40 KM (kunming) male mice were randomly divided into groups A, B, C and D. They were exposed to normal air, 30 mg/m(exp 3) CO, 300 mg/m(exp 3) CO and 600 mg/m(exp 3) CO respectively. The changes in neurobehavior function of the mice before, during and after 72 h exposure in 0.5 m(exp 3) static chambers were observed. Four indices were measured: response time (RT) and error rate (ER) in the water maze test, enter check frequency (ECF) and urine or excrement frequency (UEF) in open field test. The set upright frequency in group D was smaller than those in groups A, B and C during exposure. RT and ER values went in a direction contrary to pre-exposure the four groups in the second 3 days (6 d) after or out of exposure, while ER values showed that group D is greater than group C is greater than group A is greater than group B in the third 3 days (9 d). RT value was not different among the 4 groups, but its order of numerical value was similar to the ER order. The order of ECF values was that group C is greater than group A and group D in 3 d after or out of exposure and not different among the 4 groups in 6 d and group D is less than group A and group B in 9 d. UEF values were not different among the 4 groups in 3 d and 9 d, but group group A and group B in 6 d after or out of exposure. Comparison with every group itself, showed statistically significance increase in ER values in 9 d out of exposure than before exposure in group D. ECF values showed the statistics significant increase in 9 d in group A and B. Low concentration CO may interfere with the learning and memory of mice in the water maze and impede the development of the motor nervous function and disturb the steadiness of emotion of mice in the open field. In addition, low concentration of CO may be of tardy toxicity.

Author

Carbon Monoxide; Low Concentrations; Behavior

20000031976 Institute of Space Medico-Engineering, Beijing, China

Effects of 7 d Head-Down Tilt(-20 deg) Immobilization on Pharmacokinetics of Gentamicin in Rabbits

Guo, Zhi-Feng, Institute of Space Medico-Engineering, China; Gao, Jian-Yi, Institute of Space Medico-Engineering, China; Wang, Bao-Zhen, Institute of Space Medico-Engineering, China; Shi, Hong-Zhi, Institute of Space Medico-Engineering, China; Wang, Jing, Institute of Space Medico-Engineering, China; Qian, Jin-Kang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 333-337; In Chinese

Report No.(s): CN-11-2774/R; No Copyright; Avail: Issuing Activity

The objective is to observe pharmacokinetic changes under simulated weightlessness in relevant to body flood flow changes. Gentamicin was selected as probe drug in the present study, and rabbits exposed to Head-Down Tilt (HDT, -20 deg) immobilization were selected as simulated weightlessness animal model. Seven rabbits were treated inf. with 3 mg/kg of gentamicin sulfate pre-HDT and 7 d after HDT. Gentamicin blood samples within 4 h after administration were analyzed by TDxFLx. The distribution of gentamicin postponed significantly: a significant decrease in t from $(0.1838 \pm 0.1076) \text{ min}(\text{exp } -1)$ before HDT to $(0.0591 \pm 0.0334) \text{ min}(\text{exp } -1)$ after HDT; a significant increase in $t(1/2) \alpha$ from $(5.30 \pm 3.55) \text{ min}$ to $(15.04 \pm 7.49) \text{ min}$; a significant decrease in $k(12)$ from $(0.1025 \pm 0.0721) \text{ min}(\text{exp } -1)$ to $(0.0181 \pm 0.0161) \text{ min}(\text{exp } -1)$, a increase trend in $V(C)$ and $V(D)$,

After HDT, CL(s) of gentamicin increased from $(2.2 \pm 0.5) \text{ ml. min}(\text{exp}^{-1}).\text{kg}(\text{exp}^{-1})$ to $(2.7 \pm 0.3)\text{ml.min}(\text{exp}^{-1}).\text{kg}(\text{exp}^{-1})$. Simulated weightlessness might induce pharmacokinetic changes.

Author

Physiological Responses; Head Down Tilt; Immobilization; Pharmacology; Hypokinesia

20000031978 Chinese Academy of Medical Sciences, Inst. of Medicinal Plant Development, Beijing, China

Effects of Gastrodia on Rotation Induced Motion Sickness in Mice

Wang-Sheng-Ping, Chinese Academy of Medical Sciences, China; Liu, Xin-Min, Chinese Academy of Medical Sciences, China; Shang, Wei-Fen, Chinese Academy of Medical Sciences, China; Song, Jie, Chinese Academy of Medical Sciences, China; Yu, Shu-Ren, Chinese Academy of Medical Sciences, China; Sun, Shao-Mei, Chinese Academy of Medical Sciences, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 342-345; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to observe the effect of Gastrodia on motion sickness induced by rotation in mice. Clockwise and anticlockwise accelerated rotations up to 180 deg/s for 10 min were used to induce symptoms of motion sickness such as condition taste aversion (CTA), decrease of spontaneous locomotion and impaired ability of space identification in water-maze. Gastrodia could improve the response of CTA, increase spontaneous locomotion, and enhance the ability of learning and memory in water-maze in mice after the rotation. Symptoms of motion sickness induced by rotation could be improved by Gastrodia treatment.

Author

Rotation; Motion Sickness

20000032108 Mitre Corp., Jason Program Office, McLean, VA USA

Data Mining and the Human Genome

Joyce, Gerald F.; Abarbanel, Henry; Callan, Curtis; Dally, William; Dyson, Freeman; Jan. 07, 2000; 38p; In English

Contract(s)/Grant(s): 13-958534-04

Report No.(s): AD-A373525; JSR-99-310; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

As genomics research moves from an era of data acquisition to one of both acquisition and interpretation, new methods are required for organizing and prioritizing the data. These methods would allow an initial level of data analysis to be carried out before committing resources to a particular genetic locus. This JASON study sought to delineate the main problems that must be faced in bioinformatics and to identify information technologies that can help to overcome those problems. While the current influx of data greatly exceeds what biologists have experienced in the past, other scientific disciplines and the commercial sector have been handling much larger datasets for many years. Powerful data mining techniques have been developed in other fields that, with appropriate modification, could be applied to the biological sciences.

DTIC

Genetics; Data Acquisition; Mining; Data Management; Genetic Engineering

20000032195 Tuskegee Inst., Center for Food and Environmental Systems for Human Exploration of Space, AL USA

Analysis of proteins involved in biodegradation of crop biomass

Crawford, Kamau, Tuskegee Inst., USA; Trotman, Audrey, Tuskegee Inst., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 474-479; In English; See also 20000032189

Contract(s)/Grant(s): NCC9-51; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The biodegradation of crop biomass for re-use in crop production is part of the bioregenerative life support concept proposed by the National Aeronautics and Space Administration (NASA) for long duration, manned space exploration. The current research was conducted in the laboratory to evaluate the use of electrophoretic analysis as a means of rapidly assaying for constitutive and induced proteins associated with the bacterial degradation of crop residue. The proteins involved in crop biomass biodegradation are either constitutive or induced. As a result, effluent and cultures were examined to investigate the potential of using electrophoretic techniques as a means of monitoring the biodegradation process. Protein concentration for optimum banding patterns was determined using the Bio-Rad Protein Assay kit. Four bacterial soil isolates were obtained from the G.W. Carver research Farm at Tuskegee University and used in the decomposition of components of plant biomass. The culture, WDS_t3A was inoculated into 500 mL of either Tryptic Soy Broth or Nutrient Broth. Incubation, with shaking of each flask was for 96 hours at 30 C. The cultures consistently gave unique banding patterns under denaturing protein electrophoresis conditions, The associated extracellular enzymes also yielded characteristic banding patterns over a 14-day period, when native electrophoresis techniques were used to

examine effluent from batch culture bioreactors. The current study evaluated sample preparation and staining protocols to determine the ease of use, reproducibility and reliability, as well as the potential for automation.

Author

Proteins; Biodegradation; Crop Growth; Biomass; Soils; Reuse; Life Support Systems

20000032196 Morehouse School of Medicine, Atlanta, GA USA

Protein Kinases Possibly Mediate Hypergravity-Induced Changes in F-Actin Expression by Endothelial Cells

Love, Felisha D., Morehouse School of Medicine, USA; Melhado, Caroline D., Morehouse School of Medicine, USA; Bosah, Francis N., Morehouse School of Medicine, USA; Harris-Hooker, Sandra A., Morehouse School of Medicine, USA; Sanford, Gary L., Morehouse School of Medicine, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volume 2 and 3, pp. 480-482; In English; See also 20000032189

Contract(s)/Grant(s): NCCW-8; NAG9-644; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Basic cellular functions such as electrolyte concentration, cell growth rate, glucose utilization, bone formation, response to growth stimulation, and exocytosis are modified in microgravity. These studies indicate that microgravity affects a number of physiological systems and included in this are cell signaling mechanisms. Rijken and coworkers performed growth factor studies that showed PKC signaling and actin microfilament organization appears to be sensitive to microgravity, suggesting that the inhibition of signal transduction by microgravity may be related to alterations in actin microfilament organization. However, similar studies have not been done for vascular cells. Vascular endothelial cells play critical roles in providing nutrients to organ and tissues and in wound repair. The major deterrent to ground-based microgravity studies is that it is impossible to achieve true microgravity for longer than a few minutes on earth. Hence, it has not been possible to conduct prolonged microgravity studies except for two models that simulate certain aspects of microgravity. However, hypergravity is quite easily achieved. Several researchers have shown that hypergravity will increase the proliferation of several different cell lines while decreasing cell motility and slowing liver regeneration following partial hepatectomy. These studies indicate the hypergravity also alters the behavior of most cells. Several investigators have shown that hypergravity affects the activation of several protein kinases (PKs) in cells. In this study, we investigated whether hypergravity alters the expression of f-actin by bovine aortic endothelial cells (BAECs) and the role of PK's (calmodulin 11 dependent, PKA and PKC) as mediators of these effects.

Author

Proteins; High Gravity Environments; Electrolytic Cells; Cardiovascular System; Cell Division; Microgravity; Stimulation; Bones; Liver

20000032197 Tuskegee Inst., Center for Food and Environmental Systems for Human Exploration of Space, AL USA

Biodegradation of Fresh vs. Oven-Dried Inedible Crop Residue in a Continuously Stirred Tank Reactor

Crawford, Kamau, Tuskegee Inst., USA; Strayer, Richard, Tuskegee Inst., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 483-488; In English; See also 20000032189

Contract(s)/Grant(s): NCC9-51; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The degradation of soluble organics and mineral recovery from fresh and oven-dried biomass were compared in an Intermediate-Scale Aerobic Bioreactor (8 L working volume) to determine if drying crop residue improves performance in a continuously stirred tank reactor (CSTR). The study was conducted in an Intermediate-Scale Aerobic Bioreactor (ISAB) CSTR with dimensions of 390 mm height x 204 mm diameter. The pH in the bioreactor was controlled at 6.0, temperature at 30 C, and aeration at 7.0 L/min. Gases monitored were CO₂ evolution and dissolved oxygen. Homogeneously mixed wheat cultures, used either fresh or oven-dried biomass and were leached, then placed in the ISAB for a 4-day degradation period. Studies found that mineral recovery was greater for leached oven-dried crop residue. However, after activity by the mixed microbial communities in the ISAB CSTR, there were little notable differences in the measured mineral recovery and degradation of soluble organic compounds. Degradation of soluble organic compounds was also shown to improve for leached oven-dried crop residue, but after mixing in the CSTR the degradation of the fresh biomass seemed to be slightly greater. Time for the biomass to turn in the CSTR appeared to be one factor for the experimental differences between the fresh and oven-dried biomass. Other factors, although not as defined, were the differing physical structures in the cell walls and varying microbial components of the fresh and oven-dried treatments due to changes in chemical composition after drying of the biomass.

Author

Biodegradation; Crop Growth; Bioreactors; Drying; Farm Crops; Organic Compounds; Ovens; Temperature Control

20000032203 Texas Univ., Pan American Center for Earth and Environmental Studies, El Paso, TX USA

Applied Statistical Methods to Predict the Northward Migration of Africanized Honey Bees

Vargas, Gabriel, Texas Univ., USA; Muniz, Margarita, Texas Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3507-511, pp. 507-511; In English; See also 20000032189; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Africanized Honey Bees have been slowly migrating north from South America since the 1950's. Miles and miles make up their migration path that seems to ignore boundaries, crossing the Texas Mexico border in 1990. Many counties in the lower valley of Texas became infected zones and serious attacks, some including one thousand plus stings on humans were reported in some areas. Our research team is committed to find out what will stop the northward migration pattern. We believe that there exists natural phenomena which we consider are and will be variables that alter their migration pattern. The State of Texas has been broken into ten ecological areas to search for characteristics that are exclusive to each. Variables such as annual average temperature, precipitation, water bodies, vegetation, and the number of successive days between frosts have been carefully selected to start our research. The northern portion of Texas contains a unique feature that the AHB's have not encountered in their long journey. This feature is colder temperatures than those found in the South. We are working on a model that will consist of a series of experiments that will conclude with a high percent of certainty that temperature is of high impact on the AHB's migration pattern. To aid in the tracking of the AHB's ground cover, the Spans Explorer, a Geographical Information System (GIS) tool is being utilized. The Spans Explorer software transforms our PC into a library of data, which is collected from various resources. This database is enriched with information for each of the 255 counties in the state of Texas that can be analyzed and correlated. Our research is based on information which, can be extracted from geological maps. Information on temperature, precipitation, water bodies, vegetation, and the number of successive days between frosts are patiently taken for each county. Our database is setup for user input of all county information. The various variables are compared and correlation between them is determined. The variables mentioned for our research were gathered for all areas whether they are mountains and basins, plains, coastal areas, prairies, or piney woods. A total of ten separate areas divide the entire state and these ten areas are used as the classification scheme for the collected data. These ten areas are: 1. Piney woods, 2. Gulf prairies and Marshes, 3. Post oak Savannah, 4. Backland prairies, 5. Coast Timbers and Prairies, 6. South Texas Plains, 7. Edwards Plateau, 8. Rolling Plains, 9. High plains, and 10. Trans Pecos and Mountains. All information pertaining to annual precipitation, temperature, the number of frost-free days, and the amount of surface lake acres have been entered to the Spans software for each and every county in each of the ten ecological areas.

Author

Bees; Data Bases; Geological Surveys; Migration; North America; Statistical Analysis; Surface Water; Transformations (Mathematics)

20000032209 Tuskegee Inst., AL USA

Photosynthetic Response to Long- and Short-Term Changes in Carbon Dioxide in Sweetpotatoes Grown Hydroponically with Enhanced Mineral Nutrition

Hamilton, Casey, Tuskegee Inst., USA; Terse, Anita, Tuskegee Inst., USA; Hileman, Douglas R., Tuskegee Inst., USA; Mortley, Desmond G., Tuskegee Inst., USA; Hill, Jill, Tuskegee Inst., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 34-39; In English; See also 20000032189

Contract(s)/Grant(s): NCC9-51; NAGW-2940; USDA-ALX-FS-2; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Sweetpotato [*Ipomoea batatas* L.(Lam.)] has been selected by NASA as a potential food for long-term space missions. In previous experiments, sweetpotato plants grown hydroponically under elevated levels of CO₂ depleted the nitrogen in the nutrient solution between the bi-weekly solution replacements. In this experiment, the effect of enhanced nutrient replenishment on photosynthetic rates of sweetpotato was determined. CO₂ response curves were determined for "TU-82-155" and "Georgia-Jet" sweetpotatoes grown hydroponically in growth chambers at three different CO₂ concentrations (400, 750, and 1000 micro-mol/mol CO₂). Gas exchange measurements were made using infrared gas analysis, an open-flow gas exchange system, and a controlled-climate cuvette. Photosynthetic measurements were made at CO₂ concentrations from 50-1000 micro-mol/mol CO₂. Net photosynthetic rates showed an increase with increasing measurement CO₂ in all nutrient regimes, but the response of photosynthetic rates to the growth CO₂ conditions varied among the experiments and between the two varieties. Enhanced mineral nutrition led to increased net photosynthetic rates in "Georgia Jet" plants, but not in "TU-82-155" plants. The results of this study will help to determine the CO₂ requirements for growth of sweetpotato on proposed space missions.

Author

Carbon Dioxide; Potatoes; Nutrition; Photosynthesis; Minerals; Gas Exchange; Space Missions; Replenishment

20000032210 Tuskegee Inst., Center for Food and Environmental Systems for Human Exploration of Space, AL USA

Automated pH Control of Nutrient Solution in a Hydroponic Plant Growth System

Smith, B., Tuskegee Inst., USA; Dogan, N., Tuskegee Inst., USA; Aglan, H., Tuskegee Inst., USA; Mortley, D., Tuskegee Inst., USA; Loretan, P., Tuskegee Inst., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 40-44; In English; See also 20000032189

Contract(s)/Grant(s): NCC9-51; USDA-ALX-FS-2; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Over the years, NASA has played an important role in providing to and the development of automated nutrient delivery and monitoring, systems for growing crops hydroponically for long term space missions. One example are the systems used in the Biomass Production Chamber (BPC) at Kennedy Space Center (KSC). The current KSC monitoring system is based on an engineering workstation using standard analog/digital input/output hardware and custom written software. The monitoring system uses completely separate sensors to provide a check of control sensor accuracy and has the ability to graphically display and store data from past experiment so that they are available for data analysis [Fortson, 1992]. In many cases, growing systems have not been fitted with the kind of automated control systems as used at KSC. The Center for Food and Environmental Systems for Human Exploration of Space (CFESH) located on the campus of Tuskegee University, has effectively grown sweetpotatoes and peanuts hydroponically for the past five years. However they have adjusted the pH electrical conductivity and volume of the hydroponic nutrient solution only manually at times when the solution was to be replenished or changed out according to its protocol (e.g. one-week, two-week, or two-day cycle). But the pH of the nutrient solution flowing through the channel is neither known nor controlled between the update, change out, or replenishment period. Thus, the pH of the nutrient solution is not held at an optimum level over the span of the plant's growth cycle. To solve this dilemma, an automated system for the control and data logging of pH data relative to sweetpotato production using the nutrient film technique (NFT) has been developed. This paper discusses a microprocessor-based system, which was designed to monitor, control, and record the pH of a nutrient solution used for growing sweetpotatoes using NFT.

Derived from text

Vegetation Growth; Potatoes; Automatic Control; pH; Computer Programs; Computers; Biomass; Minerals

20000032214 Tuskegee Inst., Center for Food and Environmental Systems for Human Exploration of Space, AL USA

A System for Managing Replenishment of a Nutrient Solution Using an Electrical Conductivity Controller

Davis, D., Tuskegee Inst., USA; Dogan, N., Tuskegee Inst., USA; Aglan, H., Tuskegee Inst., USA; Mortley, D., Tuskegee Inst., USA; Loretan, P., Tuskegee Inst., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 51-56; In English; See also 20000032189

Contract(s)/Grant(s): NCC9-51; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Control of nutrient solution parameters is very important for the growth and development of plants grown hydroponically. Protocols involving different nutrient solution replenishment times (e.g. one-week, two-week, or two-day replenishment) provide manual periodic control of the nutrient solution's electrical conductivity (EC). Since plants take-up nutrients as they grow, manual control has a drawback in that EC is not held constant between replenishments. In an effort to correct this problem the Center for Food and Environmental Systems for Human Exploration of Space at Tuskegee University has developed a system for managing and controlling levels of EC over a plant's entire growing cycle. A prototype system is being tested on sweetpotato production using the nutrient film technique (NFT), and it is being compared to a system in which sweetpotatoes are grown using NFT with manual control. NASA has played an important role in the development of environmental control systems. They have become a forerunner in growing plants hydroponically with some control systems through the use of networked data acquisition and control using environmental growth chambers. Data acquisition systems which involve the use of real-time, calibration, set points, user panel, and graphical representation programming provide a good method of controlling nutrient solution parameters such as EC and pH [Bledsoe, 1993]. In NASA's Biomass Production Chamber (BPC) at Kennedy Space Center, control is provided by a programmable logic controller (PLC). This is an industrial controller which combines ladder computer logic which has the ability to handle various levels of electrical power. The controller controls temperature, light and other parameters that affect the plant's environment, in the BPC, the Nutrient Delivery System (NIX), a sub-system of the PLC, controls nutrient solution parameters such as EC, pH, and solution levels. When the nutrient EC measurement goes outside a preset range (120-130 mS/m) a set amount of a stock solution of nutrients is automatically added by a metering pump to bring the EC back into operating range [Fortson, 1992]. This paper describes a system developed at Tuskegee University for controlling the EC of a nutrient solution used

for growing sweetpotatoes with an EC controller and a computer with LabView data acquisition and instrumentation software. It also describes the preliminary data obtained from the growth of sweetpotatoes using this prototype control system.

Derived from text

Vegetation Growth; Potatoes; Electrical Resistivity; Controllers; Control Systems Design; Minerals; Biomass; Real Time Operation; Replenishment

20000032305 New Mexico Univ., Dept. of Electrical and Computer Engineering, Albuquerque, NM USA

Image Acquisition and the Eye of the Fly

Moya, John A., New Mexico Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 830-835; In English; See also 20000032189

Report No.(s): 98URC148; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Detailed study has been carried out on various animal eyes, such as those of the fly. The fly's eye possesses certain significant advantages which have made it among one of the most investigated. One of these is its structure, which allows one to study a very small portion and still gain an understanding of the larger eye. In this paper, a model of the sensory portion of the fly's eye is presented. The effectiveness of the model is briefly addressed by a comparison of its performance with experimental data.

Author

Eye (Anatomy); Mathematical Models; Insects; Image Processing; Photoreceptors

20000032441 Ohio State Univ., Dept. of Plant Biology, Columbus, OH USA

Differentiation and Tropisms in Space-Grown Moss Final Report, 15 Dec. 1995 - 15 Dec. 1999

Sack, Fred D., Ohio State Univ., USA; Kern, Volker, Ohio State Univ., USA; [1999]; 3p; In English

Contract(s)/Grant(s): NAG10-0179

Report No.(s): OSURF-731847; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This grant supported a Space Shuttle experiment on the effects of microgravity on moss cells. Moss provides a rich system for gravitational and spaceflight research. The early phase of the moss life cycle consists of chains of cells that only grow only at their tips. In the moss *Ceratodon purpureus* these filaments (protonemata) grow away from gravity in the dark, in a process called gravitropism. The tipmost cells, the apical cells, contain heavy starch-filled bodies called amyloplasts that probably function in g-sensing and that sediment within the apical cell. The SPM-A (Space Moss aka SPAM) experiment flew in November - December, 1997 on STS-87 as part of the Collaborative US Ukrainian Experiment (CLTE). The experiment was accommodated in hardware purpose-built by NASA KSC and Bionetics and included Petri Dish Fixation Units (PDFU) and BRIC-LEDs. Together, this hardware allowed for the culture of the moss on agar in commercial petri dishes, for unilateral illumination with red light of varying intensity, and for chemical fixation in situ. The key findings of the spaceflight were quite unexpected. Neither the orientation of tip-growth nor the distribution of amyloplasts was random in microgravity.

Author

Spaceborne Experiments; Tropism; Microgravity; Gravitation; Gravitropism

20000032456 Scripps Institution of Oceanography, La Jolla, CA USA

Prebiotic Evolution of Nitrogen Compounds Final Report, 1996-1999

Arrhenius, G., Scripps Institution of Oceanography, USA; [1999]; 5p; In English; Sponsored in part by the Wallenberg Foundation

Contract(s)/Grant(s): NAG5-4563; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Support from this four year grant has funded our research on two general problems. One involves attempts to model the abiotic formation of simple source compounds for functional biomolecules, their concentration from dilute state in the hydrosphere and, in several cases, surface induced reactions to form precursor monomers for bioactive end products (refs. 1-5). Because of the pervasiveness and antiquity of phosphate based biochemistry and the catalytic activity of RNA we have exploring the hypothesis of an RNA World as an early stage in the emergence of life. This concept is now rather generally considered, but has been questioned due to the earlier lack of an experimentally demonstrated successful scheme for the spontaneous formation of ribose phosphate, the key backbone molecule in RNA. That impediment has now been removed. This has been achieved by demonstrating probable sources of activated (condensed) highly soluble and strongly sorbed phosphates in nature (Refs. 1,2) and effective condensation of aldehyde phosphates to form ribose phosphate in high yield (ref.6), thereby placing the RNA World concept on a somewhat safer experimental footing. Like all work in this field these experiments are oversimplifications that largely ignore competing side reactions with other compounds expected to be present. None the less our choice of experimental conditions aim

at selective processes that eliminate interfering reactions. We have also sought to narrow the credibility gap by simulating geophysically and geochemically plausible conditions surrounding the putative prebiotic reactions.

Author

Nitrogen Compounds; Catalytic Activity; Surface Reactions; Biochemistry

20000032988 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Method for Relative Measurements of the Acoustic Nonlinearity Parameter in Liquids and Biological Tissues at Very High Frequencies

Suzuki, Tsunehisa, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 219-220; In Japanese; Copyright; Avail: Issuing Activity

In this paper, transmission line method for the measurement of the acoustic nonlinearity parameter of liquids and biological tissues at very high frequencies was investigated experimentally as follows: (i) A new method by sweeping the ultrasonic frequency (f-sweeping method) suitable for the measurement of the nonlinearity parameter of tissues. (ii) The relative measurement using water as the reference material to eliminate the problem of diffraction effects. (iii) The effects of diffraction on the measurements.

Author

Acoustic Measurement; Liquids; Nonlinearity; Tissues (Biology); Ultrasonics

20000033303 Research and Technology Organization, Human Factors and Medicine, Neuilly-sur-Seine, France

Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management *Les differences entre individus concernant les facultes d'adaptation aux rythmes irreguliers activite-repos/ Le point sur l'utilisation des medicaments pour la gestion des periodes veille-sommeil*

Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000; 171p; In English, 3-4 Jun. 1999, Venice, Italy; See also 20000033304 through 20000033323 Report No.(s): RTO-MP-31; AC/323(HFM)TP/11; ISBN 92-837-1031-2; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche; C01, CD-ROM

This Lecture Series evaluates the human factors implications for pilots of "superagile flight", specifically with regard to agile airframes, agile weapons, and rapidly configurable systems. During interviews, experienced pilots have confirmed the operational need for military aircraft agility. Although pilots have noted that their experiences to date have not caused them any major concerns regarding the potential for physiological problems, significant gaps remain in our understanding of the effects of multi-axis accelerations. Human consequences are also anticipated in the area of situational awareness. Presentation of aircraft attitude and energy state in a helmet mounted display will be a design challenge. The minimal constraints on aircraft incidence angles and the expanded weapon launch envelopes anticipated with the forthcoming and next generations of air systems requires the provision of novel displays to enable pilots to effectively operate such air systems. Decision aids, intelligent interfaces and automated subsystems are required to enable pilots to maintain situational awareness whilst coping with dramatic increases in the tempo of the tactical situation and the 'data deluge'. Moreover, many of the current pilot protection systems will be inadequate for everyday use in such an unconstrained flight envelope and during ejection. Additional challenges in selection, simulation, and training are also anticipated

Author

Human Factors Engineering; Decision Support Systems; Drugs; Sleep; Rhythm (Biology)

20000033527 Medical Research Council, Radiation and Genome Stability Unit, Harwell, UK

Further Development of the Laser-Plasma Induced X-Ray Source for Cellular Radiobiology and DNA Biochemistry

Hill, M. A., Medical Research Council, UK; Stevens, D. L., Medical Research Council, UK; Fulford, J., Medical Research Council, UK; O'Neill, P., Medical Research Council, UK; Goodhead, D. T., Medical Research Council, UK; Nottola, A., Essex Univ., UK; Tallents, G. J., Essex Univ., UK; Shaikh, W., Rutherford Appleton Lab., UK; Westhall, J., Rutherford Appleton Lab., UK; Turcu, E., Rutherford Appleton Lab., UK; Central Laser Facility, Rutherford Appleton Laboratory; 1999, pp. 140; In English; See also 20000033474; Copyright; Avail: Issuing Activity

Ultrasoft X-rays provide a unique tool for investigating the intracellular mechanisms of radiation action. They produce low energy, isolated electron tracks randomly throughout the irradiated material. These electrons have well defined energies and short tracks comparable in size to those of critical Structures in the cell, such as DNA, nucleosomes and chromatin fibers. They can therefore be used as a fine probe of the energy and spatial requirements for specific types of radiation damage and so provide much needed data for understanding and modeling the processes involved. Also, these tracks are similar to the numerous secondary electrons and electron 'track ends' produced in the slowing down spectrum of more energetic electrons produced by most irradi-

ations. Hence, they are representative of this substantial component in any ionizing irradiation. The high intensity and broad X-ray beam produced by the RAL laser-plasma source is important in overcoming the high attenuation of these low energy X-rays to produce the sample dose rate required. The high intensity also allows greater flexibility in the range of potential biological and chemical endpoints open to investigation. The carbon Lyman alpha line (367 eV) is of particular interest, with an attenuation through mammalian cells and water sample not too dissimilar to that of the C(sub K)(277 eV) and Cu(sub L) (956 eV) produced by the MRC cold cathode source. In parallel with the redesign of the target chamber for these experiments, spectroscopy measurements have also been made, since knowledge of the spectrum is important in determining the mean absorbed dose to an irradiated sample.

Author

Laser Plasmas; X Ray Sources; Radiobiology; Deoxyribonucleic Acid; Biochemistry; Product Development; Fabrication; Lyman Alpha Radiation

52

AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science. For the effects of space on animals and plants see 51 Life Sciences.

20000027540 Civil Aeromedical Inst., Oklahoma City, OK USA

Blood Carbon Monoxide and Hydrogen Cyanide Concentrations in the Fatalities of Fire and Non-Fire Associated Civil Aviation Accidents, 1991-1998 *Final Report*

Chaturvedi, Arvind K., Civil Aeromedical Inst., USA; Smith, Dudley R., Civil Aeromedical Inst., USA; Canfield, Dennis V., Civil Aeromedical Inst., USA; February 2000; 14p; In English

Report No.(s): DOT/FAA/AM-00/9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Postmortem blood samples submitted to the Federal Aviation Administration's Civil Aeromedical Institute (CAMI) from fatal civil aviation accident victims are analyzed for the primary toxic combustion gases carbon monoxide (CO), as carboxyhemoglobin (COHb), and hydrogen cyanide, as cyanide (CN). These analyses are performed to establish possible exposure of victims to smoke produced during in-flight/post-crash fires or to CO leaked into cabin/cockpit from faulty exhaust/heating systems. The presence of both gases in blood would suggest that the victim was alive and inhaled smoke from a fire. If only COHb is elevated, then the accident (or death) could be the result of CO contamination of the interior. Information pertaining to blood levels of the 2 gases in aviation fatalities, in relation to the associated accidents, is scattered or not available, particularly with regard to toxicity. Therefore, considering that COHb is greater than or = 10% and CN is greater than or = 0.25 micro-g/mL are sufficient to produce some degree of undesired physiological effects, the necessary information was extracted from the CAMI's toxicology database. Biological samples from 3857 fatalities of 2837 civil aviation accidents, occurring during 1991 - 1998, were received at CAMI. Out of these, 1012 accidents, encompassing 1571 (41%) fatalities, were fire associated, whereas 1820 accidents were non-fire related. The remaining 5 accidents were of unknown fire status. There were fewer fire-related fatalities and associated accidents in the category wherein COHb is greater than or = 10% and CN is greater than or = 0.25 micro-g/mL than that in the category wherein COHb is less than 10% and CN is less than 0.25 micro-g/mL. No in-flight fire was documented in the former category, but in-flight fires were reported in 14 accidents (18 fatalities) in the latter category. No fatality under non-fire accidents was found in which the levels of both gases were determined to be at or above the stated levels. There were 15 non-fire accidents with 17 fatalities in which only COHb (10-69%) was elevated, indicating that these accidents were associated with the inhalation of CO of non-fire origin. The present study suggests that the aviation fire accidents/fatalities were fewer than the aviation non-fire accidents/fatalities, with the fact that the fire-associated fatalities had COHB and CN' at levels high enough to produce some degree of impairment/toxicity. Furthermore, the study confirms that aviation accidents related to in-flight fires and to CO-contaminated interiors are rare.

Author

Toxicology; Carbon Monoxide; Carboxyhemoglobin; Cyanides; Aircraft Accidents; Aerospace Medicine; Toxicity; Blood; Fires

20000027632 National Eye Inst., Bethesda, MD USA

Clinical Trials in Vision Research: Information for Patients

Nov. 1999; 32p; In English

Report No.(s): PB2000-102961; NIH/PUB-99-4124; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Partial Contents: What kinds of clinical trials are there; How is a clinical trial conducted; What are the benefits of participating in a clinical trial; How is patient safety protected; What questions should you ask before deciding to join a clinical trial; What is the National Eye Institute.

NTIS

Patients; Aerospace Medicine; Visual Perception

20000027646 National Inst. of Health, Office of the Director, Bethesda, MD USA

NIH Almanac: 1999 Annual Report

Sep. 1999; 170p; In English

Report No.(s): PB2000-102832; NIH/PUB-99/5; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

Begun as a one-room Laboratory of Hygiene in 1887, the National Institutes of Health today is one of the world's foremost biomedical research centers. An agency of the Department of Health and Human Services, the NIH is the Federal focal point for health research. NIH is the steward of biomedical and behavioral research for the Nation. Its mission is science in pursuit of fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to extend healthy life and reduce the burdens of illness and disability. The goals of the agency are as follows: (1) foster fundamental creative discoveries, innovative research strategies, and their applications as a basis to advance significantly the Nation's capacity to protect and improve health; (2) develop, maintain, and renew scientific human and physical resources that will assure the Nation's capability to prevent diseases; (3) expand the knowledge base in biomedical and associated sciences in order to enhance the Nation's economic well-being and ensure a continued high return on the public investment in research; (4) exemplify and promote the highest level of scientific integrity, public accountability, and social responsibility in the conduct of science.

NTIS

Human Resources; Medical Services; Health; Research Management

20000029457 Baylor Coll. of Medicine, Houston, TX USA

Novel Receptor-Based Countermeasures to Microgravity-Induced Bone Loss

O'Malley, Bert W., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-7; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The biological actions mediated by the estrogen receptor (ER), vitamin D receptor (VDR) and Ca(sup 2+) (sub o) -sensing receptor (CaR) play key roles in the normal control of bone growth and skeletal turnover that is necessary for skeletal health. These receptors act by controlling the differentiation and/or function of osteoblasts and osteoclasts, and other cell types within the bone and bone marrow microenvironment. The appropriate use of selective ER modulators (SERMS) which target bone, vitamin D analogs that favor bone formation relative to resorption, and CaR agonists may both stimulate osteoblastogenesis and inhibit osteoclastogenesis and the function of mature osteoclasts, should make it possible to prevent the reduction in bone formation and increase in bone resorption that normally contribute to the bone loss induced by weightlessness. Indeed, there may be synergistic interactions among these receptors that enhance the actions of any one used alone. Therefore, we proposed to: 1) assess the in vitro ability of novel ER, VDR and CaR agonists, alone or in combination, to modulate osteoblastogenesis and mature osteoblast function under conditions of 1g and simulated microgravity; 2) assess the in vitro ability of novel ER, VDR and CaR agonists, alone or in combination, to modulate osteoclastogenesis and bone resorption under conditions of 1g and simulated microgravity; and 3) carry out baseline studies on the skeletal localization of the CaR in normal rat bone as well as the in vivo actions of our novel ER- and VDR-based therapeutics in the rat in preparation for their use, alone or in combination, in well-established ground-based models of microgravity and eventually in space flight.

Author

Bone Demineralization; Bones; Microgravity; Biological Effects; Weightlessness; Osteoporosis; Physiological Effects

20000029458 Texas A&M Univ., College Station, TX USA

Bone Blood Flow During Simulated Microgravity: Physiological and Molecular Mechanisms

Bloomfield, Susan A., Texas A&M Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-8 - B-9; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Blood flow to bone has been shown to affect bone mass and presumably bone strength. Preliminary data indicate that blood flow to the rat femur decreases after 14 days of simulated microgravity, using hindlimb suspension (HLS). If adult rats subjected to HLS are given dobutamine, a synthetic catecholamine which can cause peripheral vasodilation and increased blood flow, the loss of cortical bone area usually observed is prevented. Further, mechanisms exist at the molecular level to link changes in bone blood flow to changes in bone cell activity, particularly for vasoactive agents like nitric oxide (NO). The decreases in fluid shear stress created by fluid flow associated with the shifts of plasma volume during microgravity may result in alterations in expression

of vasoactive agents such as NO, producing important functional effects on bone cells. The primary aim of this project is to characterize changes in 1) bone blood flow, 2) indices of bone mass, geometry, and strength, and 3) changes in gene expression for modulators of nitric oxide activity (e.g., nitric oxide synthase) and other candidate genes involved in signal transduction of mechanical loading after 3, 7, 14, 21, and 28 days of HLS in the adult rat. Using a rat of at least 5 months of age avoids inadvertently studying effects of simulated microgravity on growing, rather than adult, bone. Utilizing the results of these studies, we will then define how altered blood flow contributes to changes in bone with simulated microgravity by administering a vasodilatory agent (which increases blood flow to tissues) during hindlimb suspension. In all studies, responses in the unloaded hindlimb bones (tibial shaft, femoral neck) will be compared with those in the weightbearing humeral shaft and the non-weightbearing calvarium (skull) from the same animal. Bone volumetric mineral density and geometry will be quantified by peripheral quantitative CT; structural and material properties of the long bones will be determined by 3-point bending (tibia, humerus) or compression (femoral neck) testing to failure. A unique aspect of these studies will be defining the time course of changes in gene expression in bone cell populations with unloading, accomplished with Northern blots, in situ hybridization, and immunohistochemistry. These studies have high relevance for concurrent protocols being proposed by investigators on NSBRI Cardiovascular and Muscle teams, with blood flow data available on a number of tissues other than bone. Further, dobutamine and other Beta-agonists have been tested as countermeasures for altered muscle and cardiovascular function. Results of the intervention tested in our studies have potential relevance for a number of systemic changes seen with prolonged spaceflight.

Author

Blood Flow; Bones; Microgravity; Weightlessness; Bone Demineralization

20000029460 Johns Hopkins Univ., Baltimore, MD USA

Skeletal Structural Consequences of Reduced Gravity Environments

Ruff, Christopher B., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-12 - B-14; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The overall goal of this project is to provide structurally meaningful data on bone loss after exposure to reduced gravity environments so that more precise estimates of fracture risk and the effectiveness of countermeasures in reducing fracture risk can be developed. The project has three major components: (1) measure structural changes in the limb bones of rats subjected to complete and partial nonweightbearing, with and without treatment with ibandronate and periodic full weightbearing; (2) measure structural changes in the limb bones of human bedrest subjects, with and without treatment with alendronate and resistive exercise, and Russian cosmonauts flying on the Mir Space Station; and (3) validate and extend the 2-dimensional structural analyses currently possible in the second project component (bedrest and Mir subjects) using 3-dimensional finite element modeling techniques, and determine actual fracture-producing loads on earth and in space.

Author

Bone Demineralization; Finite Element Method; Microgravity; Musculoskeletal System; Bioastronautics

20000029461 Brigham and Women's Hospital, Boston, MA USA

Cardiovascular Deconditioning in Humans: Human Studies Core

Williams, Gordon, Brigham and Women's Hospital, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-18 - B-19; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Major cardiovascular problems, secondary to cardiovascular deconditioning, may occur on extended space missions. While it is generally assumed that the microgravity state is the primary cause of cardiovascular deconditioning, sleep deprivation and disruption of diurnal rhythms may also play an important role. Factors that could be modified by either or both of these perturbations include: autonomic function and short-term cardiovascular reflexes, vasoreactivity, circadian rhythm of cardiovascular hormones (specifically the renin-angiotensin system) and renal sodium handling and hormonal influences on that process, venous compliance, cardiac mass, and cardiac conduction processes. The purpose of the Human Studies Core is to provide the infrastructure to conduct human experiments which will allow for the assessment of the likely role of such factors in the space travel associated cardiovascular deconditioning process and to develop appropriate countermeasures. The Core takes advantage of a newly-created Intensive Physiologic Monitoring (IPM) Unit at the Brigham and Women's Hospital, Boston, MA, to perform these studies. The Core includes two general experimental protocols. The first protocol involves a head down tilt bed-rest study to simulate microgravity. The second protocol includes the addition of a disruption of circadian rhythms to the simulated microgravity environment. Before and after each of these environmental manipulations, the subjects will undergo acute stressors simulating changes in volume and/or stress, which could occur in space and on return to Earth. The subjects are maintained in a rigidly controlled environment with fixed light/dark cycles, activity pattern, and dietary intake of nutrients, fluids, ions and calories.

Author

Cardiovascular System; Circadian Rhythms; Heart; Microgravity; Sleep Deprivation; Physiological Tests; Bioastronautics

20000029462 Massachusetts Inst. of Tech., Cambridge, MA USA

Cardiovascular Deconditioning in Humans: Alteration in Cardiovascular Regulation and Function During Simulated Microgravity

Cohen, Richard, Massachusetts Inst. of Tech., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-20 - B-21; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Alterations in cardiovascular regulation and function that occur during and after space flight have been reported. These alterations are manifested, for example, by reduced orthostatic tolerance upon reentry to the earth's gravity from space. However, the precise physiologic mechanisms responsible for these alterations remain to be fully elucidated. Perhaps, as a result, effective countermeasures have yet to be developed. In this project we apply a powerful, new method - cardiovascular system identification (CSI) - for the study of the effects of space flight on the cardiovascular system so that effective countermeasures can be developed. CSI involves the mathematical analysis of second-to-second fluctuations in non-invasively measured heart rate, arterial blood pressure (ABP), and instantaneous lung volume (ILV - respiratory activity) in order to characterize quantitatively the physiologic mechanisms responsible for the couplings between these signals. Through the characterization of all the physiologic mechanisms coupling these signals, CSI provides a model of the closed-loop cardiovascular regulatory state in an individual subject. The model includes quantitative descriptions of the heart rate baroreflex, autonomic function, as well as other important physiologic mechanisms. We are in the process of incorporating beat-to-beat fluctuations of stroke volume into the CSI technique in order to quantify additional physiologic mechanisms such as those involved in control of peripheral vascular resistance and alterations in cardiac contractility. We apply CSI in conjunction with the two general protocols of the Human Studies Core project. The first protocol involves ground-based, human head down tilt bed rest to simulate microgravity and acute stressors - upright tilt, standing and bicycle exercise - to provide orthostatic and exercise challenges. The second protocol is intended to be the same as the first but with the addition of sleep deprivation to determine whether this contributes to cardiovascular alterations. In these studies, we focus on the basic physiologic mechanisms responsible for the alterations in cardiovascular regulation and function during the simulated microgravity in order to formulate hypotheses regarding what countermeasures are likely to be most effective. Compared to our original proposal, the protocol we are using has been slightly modified to lengthen the bed rest period to 16 days and streamline the data collection. These modifications provide us data on a longer bed rest period and have enabled us to increase our subject throughput. Based on review of our preliminary data we have decided to test a countermeasure which is applied the very end of the bed rest period. We will use the same bed rest protocol to test this countermeasure. We anticipate completing the baseline data collection in our first protocol plus testing of the countermeasure in an additional eight subjects, at which time we plan to initiate the second protocol which includes sleep deprivation. In future studies, we plan to apply CSI to test other potential countermeasures in conjunction with the same bed rest, sleep deprivation and acute stressor models. We also anticipate applying CSI for studying astronauts before and after space flight and ultimately, during space flight. The application of CSI is providing information relevant to the development and evaluation of effective countermeasures allowing humans to adapt appropriately upon re-exposure to a gravity field, and to live and work for longer periods of time in microgravity.

Author

Cardiovascular System; Countermeasures; Heart; Microgravity; Physical Exercise; Physiology; Sleep Deprivation; Bioastronautics

20000029463 Brigham and Women's Hospital, Boston, MA USA

Renal and Cardio-Endocrine Responses in Humans to Simulated Microgravity

Williams, Gordon H., Brigham and Women's Hospital, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-22 - B-23; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The volume regulating systems are integrated to produce an appropriate response to both acute and chronic volume changes. Their responses include changing the levels of the hormones and neural inputs of the involved systems and/or changing the responsiveness of their target tissues. Weightlessness during space travel produces a volume challenge that is unfamiliar to the organism. Thus, it is likely that these volume regulatory mechanisms may respond inappropriately, e.g., a decrease in total body volume in space and abnormal responses to upright posture and stress on return to Earth. A similar "inappropriateness" also can occur in disease states, e.g., congestive heart failure. While it is clear that weightlessness produces profound changes in sodium and volume homeostasis, the mechanisms responsible for these changes are incompletely understood. Confounding this analysis is sleep deprivation, common in space travel, which can also modify volume homeostatic mechanisms. The purpose of this project is to provide the required understanding and then to design appropriate countermeasures to reduce or eliminate the adverse effects of microgravity. To accomplish this we are addressing five Specific Aims: (1) To test the hypothesis that microgravity modifies the acute responsiveness of the renin-angiotensin-aldosterone system (RAAS) and renal blood flow; (2) Does simulated microgravity change the circadian rhythm of the volume-regulating hormones?; (3) Does simulated microgravity change the target tissue responsiveness to angiotensin 11 (AngII)?; (4) Does chronic sleep deprivation modify the circadian rhythm of the RAAS and

change the acute responsiveness of this system to posture beyond what a microgravity environment alone does? and (5) What effect does salt restriction have on the volume homeostatic and neurohumoral responses to a microgravity environment? Because the RAAS plays a pivotal role in blood pressure control and volume homeostasis, it likely is a major mediator of the adaptive cardio-renal responses observed during space missions and is a special focus of this project. Thus, the overall goal of this project is to assess the impact of microgravity and sleep deprivation in humans on volume-regulating systems. To achieve this overall objective, we are evaluating renal blood flow and the status and responsiveness of the volume-regulating systems (RAAS, atrial natriuretic peptide and vasopressin), and the adrenergic system (plasma and urine catecholamines) in both simulated microgravity and normal gravity with and without sleep deprivation. Furthermore, the responses of the volume homeostatic mechanisms to acute stimulation by upright tilt testing, standing and exercise are being evaluated before and after achieving equilibrium with these interventions.

Author

Microgravity; Renal Function; Endocrine Systems; Kidneys; Cardiovascular System; Blood Volume; Bioastronautics; Physiological Responses

20000029465 Massachusetts Inst. of Tech., Cambridge, MA USA

Computational Models of the Cardiovascular System and Its Response to Microgravity

Kamm, Roger D., Massachusetts Inst. of Tech., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-26; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Computational models of the cardiovascular system are powerful adjuncts to ground-based and in-flight experiments. We will provide NSBRI with a model capable of simulating the short-term effects of gravity on cardiovascular function. The model from this project will: (1) provide a rational framework which quantitatively defines interactions among complex cardiovascular parameters and which supports the critical interpretation of experimental results and testing of hypotheses. (2) permit predictions of the impact of specific countermeasures in the context of various hypothetical cardiovascular abnormalities induced by microgravity. Major progress has been made during the first 18 months of the program: (1) We have developed an operational first-order computer model capable of simulating the cardiovascular response to orthostatic stress. The model consists of a lumped parameter hemodynamic model and a complete reflex control system. The latter includes cardiopulmonary and carotid sinus reflex limbs and interactions between the two. (2) We have modeled the physiologic stress of tilt table experiments and lower body negative pressure procedures (LBNP). We have verified our model's predictions by comparing them with experimental findings from the literature. (3) We have established collaborative efforts with leading investigators interested in experimental studies of orthostatic intolerance, cardiovascular control, and physiologic responses to space flight. (4) We have established a standardized method of transferring data to our laboratory from the ongoing NSBRI bedrest studies. We use this data to estimate input parameters to our model and compare our model predictions to actual data to further verify our model. (5) We are in the process of systematically simulating current hypotheses concerning the mechanism underlying orthostatic intolerance by matching our simulations to stand test data from astronauts pre- and post-flight. (6) We are in the process of developing a JAVA version of the simulator which will be distributed amongst the cardiovascular team members. Future work on this project involves modifications of the model to represent a rodent (rat) model, further evaluation of the bedrest astronaut and animal data, and systematic investigation of specific countermeasures.

Author

Cardiovascular System; Computerized Simulation; Gravitational Effects; Heart Function; Hemodynamic Responses; Lower Body Negative Pressure; Mathematical Models; Microgravity; Orthostatic Tolerance; Physiological Responses; Simulation; Bioastronautics

20000029466 Massachusetts Inst. of Tech., Cambridge, MA USA

Non-Invasive Assessment of Susceptibility to Ventricular Arrhythmias During Simulated Microgravity

Cohen, Richard J., Massachusetts Inst. of Tech., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-28 - B-29; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Cardiovascular Alterations Team is currently conducting studies to determine what alterations in hemodynamic regulation result from sixteen days of simulated microgravity exposure in normal human subjects. In this project we make additional measurements on these same study subjects in order to determine whether there is an increase in susceptibility to ventricular arrhythmias resulting from simulated microgravity exposure. Numerous anecdotal and documented reports from the past 30 years suggest that the incidence of ventricular arrhythmias among astronauts is increased during space flight. For example, documented runs of ventricular tachycardia have been recorded from crew members of Skylab and Mir, there was much attention given by the lay press to Mir Commander Vasily Tslbliyev's complaints of heart rhythm irregularities in July of 1997, and cardiovascular mechanisms may have been causal in the recent death of an experimental primate shortly after return from space. In 1986, a Mir

cosmonaut, Alexander Laveikin, was brought home and replaced with an alternate cosmonaut as a result of cardiac dysrhythmias that began during extravehicular activity. Furthermore, at a joint NASA/NSBRI workshop held in January 1998, cardiac arrhythmias were identified as the highest priority cardiovascular risk to a human Mars mission. Despite the evidence for the risk of a potentially lethal arrhythmia resulting from microgravity exposure, the effects of space flight and the associated physiologic stresses on cardiac conduction processes are not known, and an increase in cardiac susceptibility to arrhythmias has never been quantified. In this project, we are determining whether simulated space flight increases the risk of developing life-threatening heart rhythm disturbances such as sustained ventricular tachycardia (defined as ventricular tachycardia lasting at least 30 seconds or resulting in hemodynamic collapse) and ventricular fibrillation. We are obtaining measures of cardiac susceptibility to ventricular arrhythmias in subjects exposed to simulated space flight in the Human Studies Core protocol being conducted by the Cardiovascular Alterations Team, which involves sixteen days of bed rest. In particular, we are applying a powerful new non-invasive technology, developed in Professor Cohen's laboratory at MIT for the quantitative assessment of the risk of life-threatening ventricular arrhythmias. This technology involves the measurement of microvolt levels of T wave alternans (TWA) during exercise stress, and was recently granted approval by the Food and Drug Administration to be used for the clinical evaluation of patients suspected to be at risk of ventricular arrhythmias. In addition, we are obtaining 24 hour Holter monitoring (to detect non-sustained ventricular tachycardia and to assess heart rate variability). We are also conducting protocols to obtain these same measures on a monthly basis for up to four months in subjects in the Bone Demineralization/calcium Metabolism Team's long term bed rest study.

Author

Arrhythmia; Cardiovascular System; Hemodynamic Responses; Microgravity; Tachycardia

20000029467 Harvard Medical School, Boston, MA USA

Circadian Entrainment, Sleep-Wake Regulation and Neurobehavioral Performance During Extended Duration Space Flight

Czeisler, Charles A.; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-33 - B-34; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Long-duration manned space flight requires crew members to maintain a high level of cognitive performance and vigilance while operating and monitoring sophisticated instrumentation. However, the reduction in the strength of environmental synchronizers in the space environment leads to misalignment of circadian phase among crew members, coupled with restricted time available to sleep, results in sleep deprivation and consequent deterioration of neurobehavioral function. Crew members are provided, and presently use, long-acting benzodiazepine hypnotics on board the current, relatively brief space shuttle missions to counteract such sleep disruption, a situation that is only likely to worsen during extended duration missions. Given the known carry-over effects of such compounds on daytime performance, together with the reduction in emergency readiness associated with their use at night, NASA has recognized the need to develop effective but safe countermeasures to allow crew members to obtain an adequate amount of sleep. Over the past eight years, we have successfully implemented a new technology for shuttle crew members involving bright light exposure during the pre-launch period to facilitate adaptation of the circadian timing system to the inversions of the sleep-wake schedule often required during dual shift missions. However for long duration space station missions it will be necessary to develop effective and attainable countermeasures that can be used chronically to optimize circadian entrainment. Our current research effort is to study the effects of light-dark cycles with reduced zeitgeber strength, such as are anticipated during long-duration space flight, on the entrainment of the endogenous circadian timing system and to study the effects of a countermeasure that consists of scheduled brief exposures to bright light on the human circadian timing system. The proposed studies are designed to address the following Specific Aims: (1) test the hypothesis that synchronization of the human circadian pacemaker will be disturbed in men and women by the reduction in LD cycle strength. (2) test the hypothesis that this disturbed circadian synchronization will result in the secretion of the sleep-promoting hormone melatonin during the waking day, disturbed sleep, reduced growth hormone secretion, and impaired performance and daytime alertness; (3) as a countermeasure, test the hypothesis that brief daily exposures to bright light (10,000 lux) will reestablish normal entrained circadian phase, resulting in improved sleep consolidation, normalized sleep structure and endogenous growth hormone secretion and enhanced daytime performance. to date, we have carried out twelve experiments to address Hypotheses 1 and 2 and data analyses are in progress. The results of the current research may have important implications for the treatment of circadian rhythm sleep disorders, such as delayed sleep phase syndrome and shift-work dyssomnia, which are anticipated to have a high incidence and prevalence during extended duration space flight such as planned for the International Space Station and manned missions to Mars.

Author

Circadian Rhythms; Mental Performance; Sleep; Human Performance; Activity Cycles (Biology)

20000029468 Pennsylvania Univ., Philadelphia, PA USA

Countermeasures to Neurobehavioral Deficits from Cumulative Partial Sleep Deprivation During Space Flight

Dinges, David F., Pennsylvania Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-35 - B-37; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This project is concerned with identifying ways to prevent neurobehavioral and physical deterioration due to inadequate sleep in astronauts during long-duration manned space flight. The performance capability of astronauts during extended-duration space flight depends heavily on achieving recovery through adequate sleep. Even with appropriate circadian alignment, sleep loss can erode fundamental elements of human performance capability including vigilance, cognitive speed and accuracy, working memory, reaction time, and physiological alertness. Adequate sleep is essential during manned space flight not only to ensure high levels of safe and effective human performance, but also as a basic regulatory biology critical to healthy human functioning. There is now extensive objective evidence that astronaut sleep is frequently restricted in space flight to averages between 4 hr and 6.5 hr/day. Chronic sleep restriction during manned space flight can occur in response to endogenous disturbances of sleep (motion sickness, stress, circadian rhythms), environmental disruptions of sleep (noise, temperature, light), and curtailment of sleep due to the work demands and other activities that accompany extended space flight operations. The mechanism through which this risk emerges is the development of cumulative homeostatic pressure for sleep across consecutive days of inadequate sleep. Research has shown that the physiological sleepiness and performance deficits engendered by sleep debt can progressively worsen (i.e., accumulate) over consecutive days of sleep restriction, and that sleep limited to levels commonly experienced by astronauts (i.e., 4 - 6 hr per night) for as little as 1 week, can result in increased lapses of attention, degradation of response times, deficits in complex problem solving, reduced learning, mood disturbance, disruption of essential neuroendocrine, metabolic, and neuroimmune responses, and in some vulnerable persons, the emergence of uncontrolled sleep attacks. The prevention of cumulative performance deficits and neuroendocrine disruption from sleep restriction during extended duration space flight involves finding the most effective ways to obtain sleep in order to maintain the high-level cognitive and physical performance functions required for manned space flight. There is currently a critical deficiency in knowledge of the effects of how variations in sleep duration and timing relate to the most efficient return of performance per unit time invested in sleep during long-duration missions, and how the nature of sleep physiology (i.e., sleep stages, sleep electroencephalographic [EEG] power spectral analyses) change as a function of sleep restriction and performance degradation. The primary aim of this project is to meet these critical deficiencies through utilization of a response surface experimental paradigm, testing in a dose-response manner, varying combinations of sleep duration and timing, for the purpose of establishing how to most effectively limit the cumulative adverse effects on human performance and physiology of chronic sleep restriction in space operations.

Author

Circadian Rhythms; Metabolism; Neurophysiology; Physiological Responses; Physiology; Sleep; Sleep Deprivation; Mental Performance; Psychomotor Performance; Astronaut Performance

20000029469 Harvard Medical School, Boston, MA USA

Quantitative EEG Monitoring of Vigilance: Effects of Sleep Deprivation, Circadian Phase and Sympathetic Activation

Dijk, Derk-Jan; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-38 - B-39; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Shuttle astronauts typically sleep only 6 to 6.5 hours per day while in orbit. This sleep loss is related to recurrent sleep cycle shifting--due to mission-dependent orbital mechanics and mission duration requirements-- and associated circadian displacement of sleep, the operational demands of space flight, noise and space motion sickness. Such sleep schedules are known to produce poor subjective sleep quality, daytime sleepiness, reduced attention, negative mood, slower reaction times, and impaired daytime alertness. Countermeasures to allow crew members to obtain an adequate amount of sleep and maintain adequate levels of neurobehavioral performance are being developed and investigated. However, it is necessary to develop methods that allow effective and attainable in-flight monitoring of vigilance to evaluate the effectiveness of these countermeasures and to detect and predict online critical decrements in alertness/performance. There is growing evidence to indicate that sleep loss and associated decrements in neurobehavioral function are reflected in the spectral composition of the electroencephalogram (EEG) during wakefulness as well as in the incidence of slow eye movements recorded by the electro-oculogram (EOG). Further-more, our preliminary data indicated that these changes in the EEG during wakefulness are more pronounced when subjects are in a supine posture, which mimics some of the physiologic effects of microgravity. Therefore, we evaluate the following hypotheses: (1) that during a 40-hour period of wakefulness (i.e., one night of total sleep deprivation) neurobehavioral function deteriorates, the incidence of slow eye-movements and EEG power density in the theta frequencies increases especially in frontal areas of the brain; (2) that the sleep deprivation induced deterioration of neurobehavioral function and changes in the incidence of slow eye movements and the spectral composition of the EEG are more pronounced when subjects are in a supine position; and (3) that based on assessment

of slow-eye movements and quantitative on-line topographical analyses of EEG during wakefulness an EEG and or EOG parameter can be derived/constructed which accurately predicts changes in neurobehavioral function.

Author

Circadian Rhythms; In-Flight Monitoring; Physiological Effects; Sleep; Sleep Deprivation; Wakefulness

20000029470 Harvard Medical School, Boston, MA USA

On-Line Analysis of Physiologic and Neurobehavioral Variables During Long-Duration Space Missions

Brown, Emery N.; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-40 - B-42; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The goal of this project is to develop reliable statistical algorithms for on-line analysis of physiologic and neurobehavioral variables monitored during long-duration space missions. Maintenance of physiologic and neurobehavioral homeostasis during long-duration space missions is crucial for ensuring optimal crew performance. If countermeasures are not applied, alterations in homeostasis will occur in nearly all-physiologic systems. During such missions data from most of these systems will be either continually and/or continuously monitored. Therefore, if these data can be analyzed as they are acquired and the status of these systems can be continually assessed, then once alterations are detected, appropriate countermeasures can be applied to correct them. One of the most important physiologic systems in which to maintain homeostasis during long-duration missions is the circadian system. to detect and treat alterations in circadian physiology during long duration space missions requires development of: 1) a ground-based protocol to assess the status of the circadian system under the light-dark environment in which crews in space will typically work; and 2) appropriate statistical methods to make this assessment. The protocol in Project 1, Circadian Entrainment, Sleep-Wake Regulation and Neurobehavioral will study human volunteers under the simulated light-dark environment of long-duration space missions. Therefore, we propose to develop statistical models to characterize in near real time circadian and neurobehavioral physiology under these conditions. The specific aims of this project are to test the hypotheses that: 1) Dynamic statistical methods based on the Kronauer model of the human circadian system can be developed to estimate circadian phase, period, amplitude from core-temperature data collected under simulated light- dark conditions of long-duration space missions. 2) Analytic formulae and numerical algorithms can be developed to compute the error in the estimates of circadian phase, period and amplitude determined from the data in Specific Aim 1. 3) Statistical models can detect reliably in near real-time (daily) significant alternations in the circadian physiology of individual subjects by analyzing the circadian and neurobehavioral data collected in Project 1. 4) Criteria can be developed using the Kronauer model and the recently developed Jewett model of cognitive -performance and subjective alertness to define altered circadian and neurobehavioral physiology and to set conditions for immediate administration of countermeasures.

Author

Circadian Rhythms; Physiology; Astronaut Performance; Psychomotor Performance; Mental Performance; Biological Models (Mathematics)

20000029472 Baylor Coll. of Medicine, Houston, TX USA

Space Flight Immunodeficiency

Shearer, William T., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-51 - B-53; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The National Aeronautics and Space Administration (NASA) has had sufficient concern for the well-being of astronauts traveling in space to create the National Space Biomedical Research Institute (NSBRI), which is investigating several areas of biomedical research including those of immunology. As part of the Immunology, Infection, and Hematology Team, the co-investigators of the Space Flight Immunodeficiency Project began their research projects on April 1, 1998 and are now just into the second year of work. Two areas of research have been targeted: 1) specific immune (especially antibody) responses and 2) non-specific inflammation and adhesion. More precise knowledge of these two areas of research will help elucidate the potential harmful effects of space travel on the immune system, possibly sufficient to create a secondary state of immunodeficiency in astronauts. The results of these experiments are likely to lead to the delineation of functional alterations in antigen presentation, specific immune memory, cytokine regulation of immune responses, cell to cell interactions, and cell to endothelium interactions.

Author

Immunity; Immunology; Physiological Responses; Sleep; Sleep Deprivation; Bioastronautics

20000029473 Baylor Coll. of Medicine, Houston, TX USA

Immune Function and Reactivation of Latent Viruses

Butel, Janet S., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-54 - B-56; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A major concern associated with long-duration space flight is the possibility of infectious diseases posing an unacceptable medical risk to crew members. One major hypothesis addressed in this project is that space flight will cause alterations in the immune system that will allow latent viruses that are endogenous in the human population to reactivate and shed to higher levels than normal, which may affect the health of crew members. The second major hypothesis being examined is that the effects of space flight will alter the mucosal immune system, the first line of defense against many microbial infections, including herpesviruses, polyomaviruses, and gastroenteritis viruses, rendering crew members more susceptible to virus infections across the mucosa. We are focusing the virus studies on the human herpesviruses and polyomaviruses, important pathogens known to establish latent infections in most of the human population. Both primary infection and reactivation from latent infection with these groups of viruses (especially certain herpesviruses) can cause a variety of illnesses that result in morbidity and, ocCASIOnally, mortality. Both herpesviruses and polyomaviruses have been associated with human cancer, as well. Effective vaccines exist for only one of the eight known human herpesviruses and available antivirals are of limited use. Whereas normal individuals display minimal consequences from latent viral infections, events which alter immune function (such as immunosuppressive therapy following solid organ transplantation) are known to increase the risk of complications as a result of viral reactivations.

Author

Infectious Diseases; Microorganisms; Viral Diseases; Viruses; Bioastronautics

20000029474 Houston Univ., TX USA

DNA Probe Design for Preflight and Inflight Microbial Monitoring

Fox, George E., Houston Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-57 - B-59; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Crew health is a dominant issue in manned space flight. Microbiological concerns, in particular, have repeatedly emerged as determinants of flight readiness. For example, in at least one case, suspected contamination of the potable water supply nearly forced a launch delay. In another instance, a crew member's urinary tract infection nearly led to early termination of the mission, in part due to the difficulty of accurately diagnosing the nature of the infection in-flight. Microbial problems are an increasing concern with the trend towards longer-duration missions. It is essential to the success of such missions that systems that deliver acceptable quality of air and water during the anticipated lifetime of the spacecraft be available. As mission duration and resupply intervals increase, it will be necessary to rely on advanced life support systems which incorporate both biological and physical-chemical recycling methods for air and water as well as provide food for the crew. It therefore is necessary to develop real-time, robust, in-flight monitoring procedures that are sensitive enough to detect less than 100 CFU (colony forming units) of bacteria per 100 milliliters of water. It would be desirable if the monitoring system could be readily "reprogrammed" to identify specific pathogens if an in-flight incident were to occur. Thus, the monitoring technology must simultaneously detect many organisms of interest, be subject to miniaturization and be highly automated. The long range goal of project is to develop such monitoring systems.

Author

In-Flight Monitoring; Microbiology; Microorganisms; Deoxyribonucleic Acid; Aerospace Medicine

20000029475 Baylor Coll. of Medicine, Houston, TX USA

Neocytolysis: Mechanisms and Limitations

Alfrey, Clarence P., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-60 - B-61; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We uncovered the physiologic process of neocytolysis through attempts to understand the cause of "spaceflight anemia". Astronauts spending just a few days in space invariably return to earth with a 10-15% decrement in their red cell mass. This is not a benign phenomena, rendering the astronaut weak and with orthostatic hypotension on re-entry into a gravitational field. Our studies on SLS-1 and SLS-2 demonstrated normal red cell production during the first days in space, and also there was normal survival of red cells labeled with Cr-58 twelve to fourteen days before launch. Our data could only be explained by the selective hemolysis of red cells younger than twelve days old; the process named "neocytolysis". On entering microgravity, the blood normally held in the extremities pools centrally. This leads to acute central plethora, rapid loss of plasma volume through third space transudation, and a shut-off of erythropoietin elaboration. We suspect that it is the depression of erythropoietin levels below a nadir threshold that precipitates neocytolysis. to confirm this, we studied individuals acclimated to the hypoxic environment at 14,500 feet in the Peruvian Andes. On transport to sea level, we observed the predicted 10-15% fall in red cell mass over seven days, and we found that the neocytolysis was totally prevented by administration of low doses of injected erythropoietin. Also confirming our theories are our studies of hemodialysis patients who suffer a substantial shortening of red cell survival for 7-10 days after erythropoietin therapy is withdrawn. Our current project will expand our understanding of neocytolysis in a number of ways. First we wish to dissect molecular mechanisms underlying the process. We have constructed a theoretic model in which

the absence of erythropoietin effects a change in signals from endothelial cells to reticuloendothelial (R-E) phagocytes leading to an altered interaction between RE cells and neocytes. Adhesion molecules selectively expressed by neocytes are targeted. Advancing our theory is the fact that the presence of erythropoietin receptors on certain types of endothelial cells is becoming widely acknowledged (see below). We have invested effort in developing assays for a panel of adhesion molecules and determining which are selectively expressed by neocytes and thus are candidate targets for neocytolysis.

Author

Blood; Erythrocytes; Microgravity; Physiology; Anemias; Microbiology; Cytology; Blood Cells

20000029476 Baylor Coll. of Medicine, Houston, TX USA

GH/IGF-I Transgene Expression on Muscle Homeostasis

Schwartz, Robert J., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-64; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We propose to test the hypothesis that the growth hormone/ insulin like growth factor-I axis through autocrine/paracrine mechanisms may provide long term muscle homeostasis under conditions of prolonged weightlessness. As a key alternative to hormone replacement therapy, ectopic production of hGH, growth hormone releasing hormone (GHRH), and IGF-I will be studied for its potential on muscle mass impact in transgenic mice under simulated microgravity. Expression of either hGH or IGF-I would provide a chronic source of a growth-promoting protein whose biosynthesis or secretion is shut down in space. Muscle expression of the IGF-I transgene has demonstrated about a 20% increase in hind limb muscle mass over control nontransgenic litter mates. These recent experiments, also establish the utility of hind-limb suspension in mice as a workable model to study atrophy in weight bearing muscles. Thus, transgenic mice will be used in hind-limb suspension models to determine the role of GH/IGF-I on maintenance of muscle mass and whether concentric exercises might act in synergy with hormone treatment. As a means to engineer and ensure long-term protein production that would be workable in humans, gene therapy technology will be used by to monitor muscle mass preservation during hind-limb suspension, after direct intramuscular injection of a genetically engineered muscle-specific vector expressing GHRH. Effects of this gene-based therapy will be assessed in both fast twitch (medial gastrocnemius) and slow twitch muscle (soleus). End-points include muscle size, ultrastructure, fiber type, and contractile function, in normal animals, hind limb suspension, and reamputation.

Author

Hormones; Microgravity; Muscles; Proteins; Weightlessness; Biological Effects; Bioastronautics; Atrophy

20000029477 Harvard Medical School, Boston, MA USA

Pharmacological Inhibitors of the Proteasome in Atrophying Muscles

Goldberg, Alfred, Harvard Medical School, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-65 - B-67; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

It is now clear that the marked loss of muscle mass that occurs with disuse, denervation or in many systemic diseases (cancer cachexia, sepsis, acidosis, various endocrine disorders) is due primarily to accelerated degradation of muscle proteins, especially myofibrillar components. Recent work primarily in Dr. Goldberg's laboratory had suggested that in these diverse conditions, the enhancement of muscle proteolysis results mainly from activation of the Ub-proteasome degradative pathway. In various experimental models of atrophy, rat muscles show a common series of changes indicative of activation of this pathway, including increases in mRNA for Ub and proteasome subunits, content of ubiquitinated proteins, and sensitivity to inhibitors of the proteasome. In order to understand the muscle atrophy seen in weightlessness, Dr. Goldberg's laboratory is collaborating with Dr. Baldwin in studies to define the changes in these parameters upon hind-limb suspension. Related experiments will explore the effects on this degradative system of exercise regimens and also of glucocorticoids, which are known to rise in space personnel and to promote muscle, especially in inactive muscles. The main goals will be: (A) to define the enzymatic changes leading to enhanced activity of the Ub-proteasome pathway in inactive muscles upon hind-limb suspension, and the effects on this system of exposure to glucocorticoids or exercise; and (B) to learn whether inhibitors of the Ub-proteasome pathway may be useful in retarding the excessive proteolysis in atrophying muscles. Using muscle extracts, Dr. Goldberg's group hopes to define the rate-limiting, enzymatic changes that lead to the accelerated Ub-conjugation and protein degradation. They have recently developed cell-free preparations from atrophying rat muscles, in which Ub-conjugation to muscle proteins is increased above control levels. Because these new preparations seem to reproduce the changes occurring in vivo, they will analyze in depth extracts from normal and atrophying muscles to compare the activities of the Ub-activating enzyme (E1), the various LTh-carrier proteins (E2s), and Ub-protein ligases (E3s). Recent studies of other types of muscle wasting -suggest a very important role in muscle proteolysis of certain ubiquitination enzymes, E214k and E3-alpha(i.e. components of the "N-end pathway"). Future studies will focus in understanding their role and test whether they are in fact critical for muscle atrophy in vivo. Since weightlessness leads to a specific

loss of contractile proteins and to a switching of myosin isoforms, Dr. Goldberg's group will attempt to identify the ubiquitination enzymes specifically involved in myosin degradation both in normal muscle and after hind-limb suspension.

Author

Atrophy; Enzyme Activity; Enzymes; Muscles; Pharmacology; Proteins; Weightlessness; Bioastronautics

20000029478 Baylor Coll. of Medicine, Houston, TX USA

Molecular Signaling in Muscle Plasticity

Epstein, Henry F., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-69; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Extended spaceflight under microgravity conditions leads to significant atrophy of weight-bearing muscles. Atrophy and hypertrophy are the extreme outcomes of the high degree of plasticity exhibited by skeletal muscle. Stimuli which control muscle plasticity include neuronal, hormonal, nutritional, and mechanical inputs. The mechanical stimulus for muscle is directly related to the work or exercise against a load performed. Little or no work is performed by weight-bearing muscles under microgravity conditions. A major hypothesis is that focal adhesion kinase (FAK) which is associated with integrin at the adherens junctions and costameres of all skeletal muscles is an integral part of the major mechanism for molecular signaling upon mechanical stimulation in all muscle fibers. Additionally, we propose that myotonic protein kinase (DMPK) and dystrophin (DYSTR) also participate in distinct mechanically stimulated molecular signaling pathways that are most critical in type I and type II muscle fibers, respectively. To test these hypotheses, we will use the paradigms of hindlimb unloading and overloading in mice as models for microgravity conditions and a potential exercise countermeasure, respectively, in mice. We expect that FAK loss-of-function will impair hypertrophy and enhance atrophy in all skeletal muscle fibers whereas DYSTR and DMPK loss-of-function will have similar but more selective effects on Type II and Type I fibers, respectively. Gene expression will be monitored by muscle-specific creatine kinase M promoter-reporter construct activity and specific mRNA and protein accumulation in the soleus (type I primarily) and plantaris (type II primarily) muscles. With these paradigms and assays, the following Specific Project Aims will be tested in genetically altered mice: 1) identify the roles of DYSTR and its pathway; 2) evaluate the roles of the DMPK and its pathway; 3) characterize the roles of FAK and its pathway and 4) genetically analyze the mechanisms and interactions between the FAK, DYSTR, and DMPK-associated pathways in single and specific combinations of mutants. The identification of potential signaling mechanisms may permit future development of pharmacological countermeasures for amelioration and prevention of the microgravity-induced atrophy in extended spaceflight, and the analysis of both overloading and unloading paradigms may provide further support for development of exercise-based countermeasures. Understanding the basic mechanisms of molecular signaling in muscle plasticity may aid our understanding and treatment of skeletal muscle atrophy not only in spaceflight but in similar problems of the aging population, in prolonged bed rest, and in cachexia associated with chronic disease.

Author

Atrophy; Countermeasures; Microgravity; Muscles; Musculoskeletal System; Bioastronautics

20000029479 Baylor Coll. of Medicine, Houston, TX USA

Activity Dependent Signal Transduction in Skeletal Muscle

Hamilton, Susan L., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-70 - B-72; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The overall goals of this project are: 1) to define the initial signal transduction events whereby the removal of gravitational load from antigravity muscles, such as the soleus, triggers muscle atrophy, and 2) to develop countermeasures to prevent this from happening. Our rationale for this approach is that, if countermeasures can be developed to regulate these early events, we could avoid having to deal with the multiple cascades of events that occur downstream from the initial event. One of our major findings is that hind limb suspension causes an early and sustained increase in intracellular Ca^{2+} concentration ($[\text{Ca}^{2+}]_{\text{sub i}}$). In most cells the consequences of changes in $[\text{Ca}^{2+}]_{\text{sub i}}$ depend on the amplitude, frequency and duration of the Ca^{2+} signal and on other factors in the intracellular environment. We propose that muscle remodeling in microgravity represents a change in the balance among several Ca^{2+} regulated signal transduction pathways, in particular those involving the transcription factors NFAT and NF κ B and the pro-apoptotic protein BAD. Other Ca^{2+} sensitive pathways involving PKC, ras, rac, and CaM kinase II may also contribute to muscle remodeling.

Author

Atrophy; Microgravity; Muscles; Musculoskeletal System; Proteins; Calcium; Cells (Biology); Cytology; Bioastronautics

20000029480 Harvard Medical School, Boston, MA USA

Molecular Mechanisms Regulating Muscle Fiber Composition Under Microgravity

Rosenthal, Nadia A., Harvard Medical School, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-73 - B-74; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The overall goal of this project is to reveal the molecular mechanisms underlying the selective and debilitating atrophy of specific skeletal muscle fiber types that accompanies sustained conditions of microgravity. Since little is currently known about the regulation of fiber-specific gene expression programs in mammalian muscle, elucidation of the basic mechanisms of fiber diversification is a necessary prerequisite to the generation of therapeutic strategies for attenuation of muscle atrophy on earth or in space. Vertebrate skeletal muscle development involves the fusion of undifferentiated mononucleated myoblasts to form multinucleated myofibers, with a concomitant activation of muscle-specific genes encoding proteins that form the force-generating contractile apparatus. The regulatory circuitry controlling skeletal muscle gene expression has been well studied in a number of vertebrate animal systems. The goal of this project has been to achieve a similar level of understanding of the mechanisms underlying the further specification of muscles into different fiber types, and the role played by innervation and physical activity in the maintenance and adaptation of different fiber phenotypes into adulthood. Our recent research on the genetic basis of fiber specificity has focused on the emergence of mature fiber types and have implicated a group of transcriptional regulatory proteins, known as E proteins, in the control of fiber specificity. The restriction of E proteins to selected muscle fiber types is an attractive hypothetical mechanism for the generation of muscle fiber-specific patterns of gene expression. To date our results support a model wherein different E proteins are selectively expressed in muscle cells to determine fiber-restricted gene expression. These studies are a first step to define the molecular mechanisms responsible for the shifts in fiber type under conditions of microgravity, and to determine the potential importance of E proteins as upstream targets for the effects of weightlessness. In the past year we have determined that the expression of E Proteins is restricted to specific fiber types by post-transcriptional mechanisms. By far, the most prevalent mechanism of cellular control for achieving post-transcriptional regulation of gene expression is selective proteolysis -through the ubiquitin -proteasome pathway. Steady-state levels of HEB message are similar in all fast and slow skeletal muscle fiber types, yet the protein is restricted to Type IIX fibers. HEB appears to be a nodal point for regulating fiber-specific transcription, as expression of the transcription factor is regulated at the post-transcriptional level. It is not clear at present whether the regulation is at the level of protein synthesis or degradation. We are now poised to evaluate the biological role of ubiquitination in fiber specific-gene expression by controlling the post-transcriptional expression of E Proteins. The use of metabolic labelling and pharmacological inhibitors of the ubiquitin pathway will be used to identify the mode of regulation of the Type IIX expression pattern. The potential role of specific kinases in effecting the restriction of HEB expression will be examined by using both inhibitors and activators. The results of these studies will provide the necessary information to evaluate the biological role of E proteins in controlling fiber type transitions, and in potentially attenuating the atrophic effects of microgravity conditions. We have also recently shown that ectopic expression of the HEB protein transactivates the Type IIX-specific skeletal α -actin reporter. The 218 bp skeletal α -actin promoter drives transgene expression solely in mature Type IIX fibers. A mouse also carrying the transgene MLCI/HEB (which ectopically expresses the E Protein HEB in Type IIB fibers) forces expression of the skeletal α -actin reporter gene in Type IIB fibers. We can now dissect the composition of this fiber-specific cis-element. The skeletal α -actin promoter is quite compact and has been extensively characterized in vitro for activity and binding factors. The single E box may act as a binding target of myogenic factor/HEB heterodimer to allow for IIX expression. The HEB transcription factor may recognize either the precise flanking sequences of the E Box, or perhaps interacting with other proteins bound nearby, and activating expression in Type IIX fibers. This E box will be both ablated, and alternatively, as ablation may well destroy any muscle-specific transcriptional activity, flanking sequences substituted with those surrounding the E box (EI) of the myogenin promoter. Modification of fiber-specific transgene expression will be tested in transgenic mice. The results of these studies will provide basic information on the regulatory circuitry underlying fiber specificity, and will form the basis for building appropriate transgenic regulatory cassettes to effect fiber transitions in subsequent experimental manipulations on unweighted muscles.

Author

Activity (Biology); Atrophy; Cells (Biology); Microgravity; Muscles; Musculoskeletal System; Proteins; Bioastronautics

20000029481 Baylor Coll. of Medicine, Houston, TX USA

Motoneuron Influences on Muscle Atrophy in Simulated Microgravity Induced Muscle Atrophy

Mosier, Dennis R., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-75; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Many alterations in motor unit structure and function occur with exposure to microgravity during spaceflight, and could lead to impaired motor performance. While much work is ongoing to ascertain the nature of biochemical, structural, and physiological changes occurring in muscle fibers, comparatively little attention has been paid to the changes reported in motoneuron terminals at the skeletal neuromuscular junction, and in motoneuron cell bodies, during exposure to microgravity. It is highly unlikely that

these changes, whether they occur independently or secondary to changes in the innervated muscle fibers, are without consequences for the regulation of motor unit function. Accordingly, the central hypothesis of this study is that alterations in motoneuron structure and function occur during the process of microgravity-induced muscle atrophy, and that these alterations significantly influence muscle dysfunction, adaptation, and recovery from atrophy induced by microgravity. These changes may be manifested as early structural and functional alterations in the distal motoneuron terminal, in addition to alterations in motoneuron activity produced by changes in stretch reflexes and supraspinal pathways. Initiation of alterations in motoneuron terminals may be influenced by retrograde signals from muscle which induce, as an early event, changes in intracellular calcium and transmitter release. To begin to address these hypotheses, a combination of electrophysiologic assays of transmitter release at neuro-muscular junctions, coupled with electron microscopic assays of junctional remodelling, synaptic vesicles, and intraterminal calcium, is being used to define quantitatively the nature, extent, and possible significance of changes in motoneuron terminals occurring in a mouse model of unloading-induced muscle atrophy. This comprehensive approach is being further extended to determine motoneuronal responses to treatments designed to ameliorate muscle atrophy induced by unloading, and to test the hypothesis that one or more activity-dependent factors released locally by skeletal muscle may induce alterations in the presynaptic terminals of innervating motoneurons. The data obtained from this study will be useful in defining the anatomic and physiologic consequences to motoneurons of manipulations which induce muscle atrophy, and will aid in designing further experiments to determine the mechanisms influencing motor unit dysfunction occurring during space travel. Information from this study will be of value to the design and refinement of countermeasures aimed at ameliorating the deleterious effects of microgravity on human motor performance. The results of this work may also provide new insights into important clinical problems such as mechanisms influencing muscle and motor nerve injury encountered in critical care settings, motoneuron dysfunction in devastating neurodegenerative illnesses such as amyotrophic lateral sclerosis, and the design of therapies to retard or prevent muscle atrophy produced by disuse or spinal cord injury.

Author

Atrophy; Microgravity; Musculoskeletal System; Neuromuscular Transmission; Neurons; Muscles; Bioastronautics

20000029482 Johns Hopkins Univ., School of Medicine, Baltimore, MD USA

Context-Specific Adaptation of Gravity-Dependent Vestibular Reflex Responses

Shelhamer, Mark J., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-80 - B-82; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Stabilization of the eyes and head during body movements is important for maintaining balance and keeping the images of objects stationary on our retinas. Impairment of this ability can lead to disorientation and reduced performance in sensorimotor tasks such as piloting of spacecraft. In the absence of a normal earth gravity field, the dynamics of head stabilization, and the interpretation of vestibular signals that sense gravity and linear acceleration, are subject to change. Transitions between different gravito-inertial force environments - as during different phases of space flight - provide an extreme test of the adaptive mechanisms that maintain these reflexive abilities. It is vitally important to determine human adaptive capabilities in such a circumstance, so that we can know to what extent the sensorimotor skills acquired in one gravity environment will transfer to others. Our work lays the foundation for understanding these capabilities, and for determining how we can aid the processes of adaptation and readaptation. An integrated set of experiments addresses this issue. We use the general approach of adapting some type of reflexive eye movement (saccades, the angular vestibulo-ocular reflex (AVOR), the linear vestibulo-ocular reflex (LVOR)), or the vestibulo-collic reflex (VCR), to a particular change in gain or phase in one condition of gravito-inertial force, and adapting to a different gain or phase (or asking for no change) in a second gravito-inertial force condition, and then seeing if the gravito-inertial force itself - the context cue - can recall the previously learned adapted responses. The majority of the experiments in the laboratory use the direction of vertical gaze or the direction of gravity (head tilt) as the context cue. This allows us to study context-specificity in a ground-based setting. One set of experiments, to be performed in parabolic flight, specifically uses the magnitude of gravito-inertial force as a context cue. This is a much better analog of the situation encountered in space flight. Various experiments investigate the behavioral properties, neurophysiological basis, and anatomical substrate of context-specific learning mechanisms. We use otolith (gravity) signals as the contextual cue for switching between adapted states of the saccadic system, the angular and linear vestibulo-ocular reflexes, and the VCR. (By LVOR we mean the oculomotor response - horizontal, vertical, and torsional - to linear translation of the head and body.) We are studying the effect of context on adaptation of saccade gain, phase and gain of the AVOR and LVOR, on ocular counterrolling (OCR) in response to static head tilt, and on head/neck reflexes (VCR) in response to rotation in different orientations. Such research is particularly germane to potential problems of postural and oculomotor control upon exposure to different gravitational environments.

Author

Eye Movements; Gravitation; Gravitational Effects; Neurophysiology; Reflexes; Gravitational Physiology

20000029483 Massachusetts Inst. of Tech., Cambridge, MA USA

Visual Orientation in Unfamiliar Gravito-Inertial Environments

Oman, Charles M., Massachusetts Inst. of Tech., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-83 - B-85; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The goal of this project is to better understand the process of spatial orientation and navigation in unfamiliar gravito-inertial environments, and ultimately to use this new information to develop effective countermeasures against the orientation and navigation problems experienced by astronauts. How do we know our location, orientation, and motion of our body with respect to the external environment? On earth, gravity provides a convenient "down" cue. Large body rotations normally occur only in a horizontal plane. In space, the gravitational down cue is absent. When astronauts roll or pitch upside down, they must recognize where things are around them by a process of mental rotation which involves three dimensions, rather than just one. While working in unfamiliar situations they occasionally misinterpret visual cues and experience striking "visual reorientation illusions" (VRIs), in which the walls, ceiling, and floors of the spacecraft exchange subjective identities. VRIs cause disorientation, reaching errors, trigger attacks of space motion sickness, and potentially complicate emergency escape. MIR crewmembers report that 3D relationships between modules - particularly those with different visual verticals - are difficult to visualize, and so navigating through the node that connects them is not instinctive. Crew members learn routes, but their apparent lack of survey knowledge is a concern should fire, power loss, or depressurization limit visibility. Anecdotally, experience in mockups, parabolic flight, neutral buoyancy and virtual reality (VR) simulators helps. However, no techniques have been developed to quantify individual differences in orientation and navigation abilities, or the effectiveness of preflight visual orientation training. Our understanding of the underlying physiology - for example how our sense of place and orientation is neurally coded in three dimensions in the limbic system of the brain - is incomplete. During the 16 months that this human and animal research project has been underway, we have obtained several results that are not only of basic research interest, but which have practical implications for the architecture and layout of spacecraft interiors and for the development of astronaut spatial orientation training countermeasures.

Author

Disorientation; Visual Stimuli; Perceptual Errors; Visual Perception; Attitude (Inclination); Vertical Perception

20000029484 Harvard Medical School, Boston, MA USA

Advanced Techniques for Assessment of Postural and Locomotor Ataxia, Spatial Orientation, and Gaze Stability

Wall, Conrad, III, Harvard Medical School, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-86 - B-90; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In addition to adapting to microgravity, major neurovestibular problems of space flight include postflight difficulties with standing, walking, turning corners, and other activities that require stable upright posture and gaze stability. These difficulties inhibit astronauts' ability to stand or escape from their vehicle during emergencies. The long-term goal of the NSBRI is the development of countermeasures to ameliorate the effects of long duration space flight. These countermeasures must be tested with valid and reliable tools. This project aims to develop quantitative, parametric approaches for assessing gaze stability and spatial orientation during normal gait and when gait is perturbed. Two of this year's most important findings concern head fixation distance and ideal trajectory analysis. During a normal cycle of walking the head moves up and down linearly. A simultaneous angular pitching motion of the head keeps it aligned toward an imaginary point in space at a distance of about one meter in front of a subject and along the line of march. This distance is called the head fixation distance. Head fixation distance provides the fundamental framework necessary for understanding the functional significance of the vestibular reflexes that couple head motion to eye motion. This framework facilitates the intelligent design of counter-measures for the effects of exposure to microgravity upon the vestibular ocular reflexes. Ideal trajectory analysis is a simple candidate countermeasure based upon quantifying body sway during repeated up and down stair stepping. It provides one number that estimates the body sway deviation from an ideal sinusoidal body sway trajectory normalized on the subject's height. This concept has been developed with NSBRI funding in less than one year. These findings are explained in more detail below. Compared to assessments of the vestibulo-ocular reflex, analysis of vestibular effects on locomotor function is relatively less well developed and quantified. We are improving this situation by applying methodologies such as nonlinear orbital stability to quantify responses and by using multivariate statistical approaches to link together the responses across separate tests. In this way we can exploit the information available and increase the ability to discriminate between normal and pathological responses. Measures of stability and orientation are compared to measures such as dynamic visual acuity and with balance function tests. The responses of normal human subjects and of patients having well documented pathophysiologies are being characterized. When these studies are completed, we should have a clearer idea about normal and abnormal patterns of eye, head, and body movements during locomotion and their stability in a wide range of environ-

ments. We plan eventually to use this information to validate the efficacy of candidate neurovestibular and neuromuscular rehabilitative techniques. Some representative studies made during this year are summarized.

Author

Ataxia; Attitude (Inclination); Locomotion; Microgravity; Posture; Stability; Visual Acuity

20000029485 Johns Hopkins Univ., Oncology Center, Baltimore, MD USA

Radiation Effects: Core Project

Dicello, John F., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-96 - B-98; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The risks to personnel in space from the naturally occurring radiations are generally considered to be one of the most serious limitations to human space missions, as noted in two recent reports of the National Research Council/National Academy of Sciences. The Core Project of the Radiation Effects Team for the National Space Biomedical Research Institute is the consequences of radiations in space in order to develop countermeasure, both physical and pharmaceutical, to reduce the risks of cancer and other diseases associated with such exposures. During interplanetary missions, personnel in space will be exposed to galactic cosmic rays, including high-energy protons and energetic ions with atomic masses of iron or higher. In addition, solar events will produce radiation fields of high intensity for short but irregular durations. The level of intensity of these radiations is considerably higher than that on Earth's surface, and the biological risks to astronauts is consequently increased, including increased risks of carcinogenesis and other diseases. This group is examining the risk of cancers resulting from low-dose, low-dose rate exposures of model systems to photons, protons, and iron by using ground-based accelerators which are capable of producing beams of protons, iron, and other heavy ions at energies comparable to those encountered in space. They have begun the first series of experiments using a 1-GeV iron beam at the Brookhaven National Laboratory and 250-MeV protons at Loma Linda University Medical Center's proton synchrotron facility. As part of these studies, this group will be investigating the potential for the pharmaceutical, Tamoxifen, to reduce the risk of breast cancer in astronauts exposed to the level of doses and particle types expected in space. Theoretical studies are being carried out in a collaboration between scientists at NASA's Johnson Space Center and Johns Hopkins University in parallel with the experimental program have provided methods and predictions which are being used to assess the levels of risks to be encountered and to evaluate appropriate strategies for countermeasures. Although the work in this project is primarily directed toward problems associated with space travel, the problem of protracted exposures to low-levels of radiation is one of national interest in our energy and defense programs, and the results may suggest new paradigms for addressing such risks.

Author

Cancer; Radiation Effects; Biological Effects; Physiological Effects; Aerospace Medicine; Bioastronautics; Health Physics; Radiation Injuries; Countermeasures

20000029486 Johns Hopkins Univ., Oncology Center, Baltimore, MD USA

Radiation-Induced Cytogenetic Damage as a Predictor of Cancer Risk for Protons and Fe Ions

Williams, Jerry R., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-99 - B-101; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have successfully completed the series of experiments planned for year 1 and the first part of year 2 measuring the induction of chromosome aberrations induced in multiple cell types by three model space radiations: Fe-ions, protons and photons. Most of these data have now been compiled and a significant part subjected to detailed data analyses, although continuing data analysis is an important part of our current and future efforts. These analyses are directed toward defining the patterns of chromosomal damage induction by the three radiations and the extent to which such patterns are dependent on the type of cell irradiated. Our studies show significant differences, both quantitatively and qualitatively, between response of different cell types to these radiations however there is an overall pattern that characterizes each type of radiation in most cell lines. Thus our data identifies general dose-response patterns for each radiation for induction of multiple types of chromosomal aberrations but also identifies significant differences in response between some cell types. Specifically, we observe significant resistance for induction of aberrations in rat mammary epithelial cells when they are irradiated in vivo and assayed in vitro. Further, we have observed some remarkable differences in susceptibility to certain radiation-induced aberrations in cells whose genome has been modulated for two cancer-relevant genes, TP53 and CDKN1A. This data, if confirmed, may represent the first evidence of gene-specific differences in cellular metabolism of damage induced by densely-ionizing radiation that confers substantial sensitivity to protons compared to photons.

Author

Cancer; Deoxyribonucleic Acid; Photons; Radiation Damage; Mammary Glands; Ferric Ions; Biological Effects; Aerospace Medicine; Bioastronautics

20000029487 Texas A&M Univ., College Station, TX USA

Quantitation of Radiation Induced Deletion and Recombination Events Associated with Repeated DNA Sequences

Sinden, Richard R., Texas A&M Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-102 - B-104; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Manned exploration of space exposes the explorers to a complex and novel radiation environment. The galactic cosmic ray and trapped belt radiation (predominantly proton) components of this environment are relatively constant, and the variations with the solar cycle are well understood and predictable. The level of radiation encountered in low earth orbits is determined by several factors, including altitude, inclination of orbit with respect to the equator, and spacecraft shielding. At higher altitudes, and on a Mars mission, the level of radiation exposure will increase significantly. A significant fraction of the dose may be delivered by solar particle events which vary dramatically in dose rate and incident particle spectrum. High-LET radiation is of particular concern. High-LET radiation, a component of galactic cosmic rays (GCR), is comprised of a variety of charged particles of various energies (10 MeV/n to 10 GeV/n), including about 87% protons, 12% helium ions, and heavy ions (including iron). These high energy particles can cause significant damage to target cells. The different particle types and energies result in different patterns of energy deposition at the molecular and cellular level in a primary target cell. They can also cause significant damage to other, nearby cells as a result of secondary particles. Protons, for instance produce secondaries that include photons, neutrons, pions, heavy particles, as well as gamma rays. Heavy ions deposit energy in a "track" in which the magnitude of the damage varies as the particle loses energy. Heavy ions produce secondary delta rays, or electrons. The distribution of damage through tissue is described by a Bragg curve which will be characteristic for different energies. Needless to say there are differences in the RBE of protons and a particles. High-LET heavy ions are particularly damaging to cells as they do continual damage throughout their track. Differences in these energy deposition patterns can significantly influence the nature of DNA damage and the ability of cellular systems to repair such damage. It has been suspected that these differences also affect the spatial distribution of damage within the DNA of the interphase cell nucleus and produce corresponding differences in endpoints related to health effects. The interaction of a single high-LET particle with chromatin has been suggested to cause multiple double strand breaks within a relatively short distance. In part this is due to the organization of DNA into chromatin fibers in which distant regions of the DNA helix can be physically juxtaposed by the various levels of coiling of the DNA. This prediction was confirmed by the detection of the generation of double strand DNA fragments of 100-2000 bp following exposure to high-LET ions (including iron).

Author

Deoxyribonucleic Acid; Heavy Ions; Radiation Dosage; Relative Biological Effectiveness (RBE); Biological Effects; Physiological Effects; Radiation Effects; Bioastronautics; Aerospace Medicine

20000029492 Harvard Medical School, Boston, MA USA

Alterations in Cardiovascular Regulation and Function During Long-Term Simulated Microgravity

Cohen, Richard J.; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-117 - B-118; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Cardiovascular Alterations Team is conducting studies of hemodynamic regulation and susceptibility to arrhythmias resulting from sixteen days of simulated microgravity exposure. In these studies very intensive measurements are made during a short duration of bed rest. In this collaborative effort are making many of the same measurements, however much less frequently, on subjects who are exposed to a much longer duration of simulated microgravity. Alterations in cardiovascular regulation and function that occur during and after space flight have been reported. These alterations are manifested, for example, by reduced orthostatic tolerance upon reentry to the earth's gravity from space. However, the precise physiologic mechanisms responsible for these alterations remain to be fully elucidated. Perhaps, as a result, effective countermeasures have yet to be developed. In addition, numerous reports from the past 30 years suggest that the incidence of ventricular arrhythmias among astronauts is increased during space flight. However, the effects of space flight and the associated physiologic stresses on cardiac conduction processes are not known, and an increase in cardiac susceptibility to arrhythmias has never been quantified. In this project we are applying the most powerful technologies available to determine, in a ground-based study of long duration space flight, the mechanisms by which space flight affects cardiovascular function, and then on the basis of an understanding of these mechanisms to develop rational and specific countermeasures. to this end we are conducting a collaborative project with the Bone Demineralization/Calcium Metabolism Team of the National Space Biomedical Research Institute (NSBRI). The Bone Team is conducting bed rest studies in human subjects lasting 17 weeks, which provides a unique opportunity to study the effects of long duration microgravity exposure on the human cardiovascular system. We are applying a number of powerful new methods to these long term bed rest subjects, including cardiovascular system identification (CSI), microvolt level T wave alternans analysis, and

cardiac magnetic resonance imaging to assess non-invasively the effects of simulated long duration space flight on the cardiovascular system.

Author

Arrhythmia; Bone Demineralization; Cardiovascular System; Hemodynamic Responses; Microgravity; Physiological Effects; Biological Effects; Bioastronautics

20000029493 Harvard Medical School, Boston, MA USA

Acute Total and Chronic Partial Sleep Deprivation: Effects on Neurobehavioral Functions, Waking EEG and Renin-Angiotensin System

Dijk, Derk-Jan, Harvard Medical School, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-119 - B-120; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Total sleep deprivation leads to decrements in neurobehavioral performance and changes in electroencephalographic (EEG) oscillations as well as the incidence of slow eye movements as detected in the electro-oculogram (EOG) during wakefulness. Although total sleep deprivation is a powerful tool to investigate the association of EEG/EOG and neurobehavioral decrements, sleep loss during space flight is usually only partial. Furthermore exposure to the microgravity environment leads to changes in sodium and volume homeostasis and associated renal and cardio-endocrine responses. Some of these changes can be induced in head down tilt bedrest studies. We integrate research tools and research projects to enhance the fidelity of the simulated conditions of space flight which are characterized by complexity and mutual interactions. The effectiveness of countermeasures and physiologic mechanisms underlying neurobehavioral changes and renal-cardio endocrine changes are investigated in Project 3 of the Human Performance Team and Project 3 of the Cardiovascular Alterations Team respectively. Although the specific aims of these two projects are very different, they employ very similar research protocols. Thus, both projects investigate the effects of posture/bedrest and sleep deprivation (total or partial) on outcome measures relevant to their specific aims. The main aim of this enhancement grant is to exploit the similarities in research protocols by including the assessment of outcome variables relevant to the Renal-Cardio project in the research protocol of Project 3 of the Human Performance Team and by including the assessment of outcome variables relevant to the Quantitative EEG and Sleep Deprivation Project in the research protocols of Project 3 of the Cardiovascular Alterations team. In particular we will assess Neurobehavioral Function and Waking EEG in the research protocols of the renal-cardio endocrine project and renin-angiotensin and cardiac function in the research protocol of the Quantitative EEG and Waking Neurobehavioral Function project. This will allow us to investigate two additional specific aims: 1) Test the hypothesis that chronic partial sleep deprivation during a 17 day bed rest experiment results in deterioration of neurobehavioral function during waking and increases in EEG power density in the theta frequencies, especially in frontal areas of the brain, as well as the nonREM-REM cycle dependent modulation of heart-rate variability. 2) Test the hypothesis that acute total sleep deprivation modifies the circadian rhythm of the renin-angiotensin system, changes the acute responsiveness of this system to posture beyond what a microgravity environment alone does and affects the nonREM-REM cycle dependent modulation of heart-rate variability.

Author

Cardiovascular System; Eye Movements; Human Performance; Microgravity; Physiology; Sleep Deprivation; Bioastronautics; Physiological Effects

20000029494 Harvard Medical School, Boston, MA USA

Visual- and Vestibular-Autonomic Influence on Short-Term Cardiovascular Regulatory Mechanisms

Mullen, Thomas J., Harvard Medical School, USA; Ramsdell, Craig D., Harvard Medical School, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-121 - B-122; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This synergy project was a one-year effort conducted cooperatively by members of the NSBRI Cardiovascular Alterations and Neurovestibular Adaptation Teams in collaboration with NASA Johnson Space Center (JSC) colleagues. The objective of this study was to evaluate visual autonomic interactions on short-term cardiovascular regulatory mechanisms. Based on established visual-vestibular and vestibular-autonomic shared neural pathways, we hypothesized that visually induced changes in orientation will trigger autonomic cardiovascular reflexes. A second objective was to compare baroreflex changes during postural changes as measured with the new Cardiovascular System Identification (CSI) technique with those measured using a neck barocuff. While the neck barocuff stimulates only the carotid baroreceptors, CSI provides a measure of overall baroreflex responsiveness. This study involved a repeated measures design with 16 healthy human subjects (8 M, 8 F) to examine cardiovascular regulatory responses during actual and virtual head-upright tilts. Baroreflex sensitivity was first evaluated with subjects in supine

and upright positions during actual tilt-table testing using both neck barocuff and CSI methods. The responses to actual tilts during this first session were then compared to responses during visually induced tilt and/or rotation obtained during a second session.

Author

Autonomic Nervous System; Cardiovascular System; Heart Function; Physiological Responses; Bioastronautics; Bioinstrumentation

20000029495 Harvard Medical School, Boston, MA USA

Sustained Partial Sleep Deprivation: Effects on Immune Modulation and Growth Factors

Mullington, Janet M., Harvard Medical School, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-123 - B-124; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The vulnerability to medical emergencies is greatest in space where there are real limits to the availability or effectiveness of ground based assistance. Moreover, astronaut safety and health maintenance will be of increasing importance as we venture out into space for extended periods of time. It is therefore critical to understand the mechanisms of the regulatory physiology of homeostatic systems (sleep, circadian, neuroendocrine, fluid and nutritional balance) and the key roles played in adaptation. This synergy project has combined aims of the "Human Performance Factors, Sleep and Chronobiology Team"; the "Immunology, Infection and Hematology Team"; and the "Muscle Alterations and Atrophy Team", to broadly address the effects of long term sleep reduction, as is frequently encountered in space exploration, on neuroendocrine, neuroimmune and circulating growth factors. Astronaut sleep is frequently curtailed to averages of between 4- 6.5 hours per night. There is evidence that this amount of sleep is inadequate for maintaining optimal daytime functioning. However, there is a lack of information concerning the effects of chronic sleep restriction, or reduction, on regulatory physiology in general, and there have been no controlled studies of the cumulative effects of chronic sleep reduction on neuroendocrine and neuroimmune parameters. This synergy project represents a pilot study designed to characterize the effects of chronic partial sleep deprivation (PSD) on neuroendocrine, neuroimmune and growth factors. This project draws its subjects from two (of 18) conditions of the larger NSBRI project, "Countermeasures to Neurobehavioral Deficits from Cumulative Partial Sleep Deprivation During Space Flight", one of the projects on the "Human Performance Factors, Sleep and Chronobiology Team". For the purposes of this study, to investigate the effects of chronic sleep loss on neuroendocrine and neuroimmune function, we have focused on the two extreme sleep conditions from this larger study: a 4.2 hour per night condition, and a 8.2 hour per night condition. During space flight, muscle mass and bone density are reduced, apparently due to loss of GH and IGF-I, associated with microgravity. Since is greater than 70% of growth hormone (GH) is secreted at night in normal adults, we hypothesized that the chronic sleep restriction to 4 hours per night would reduce GH levels as measured in the periphery. In this synergy project, in collaboration with the "Muscle Alterations and Atrophy Team", we are measuring insulin-like growth factor-I (IGF-I) in peripheral circulation to test the prediction that it will be reduced by chronic sleep restriction. In addition to stress modulation of immune function, recent research suggests that sleep is also involved. While we all have the common experience of being sleepy when suffering from infection, and being susceptible to infection when not getting enough sleep, the mechanisms involved in this process are not understood and until recently have gone largely overlooked. We believe that the immune function changes seen in spaceflight may also be related to the cumulative effects of sleep loss. Moreover, in space flight, the possibility of compromised immune function or of the reactivation of latent viruses are serious potential hazards for the success of long term missions. Confined living conditions, reduced sleep, altered diet and stress are all factors that may compromise immune function, thereby increasing the risks of developing and transmitting disease. Medical complications, which would not pose serious problems on earth, may be disastrous if they emerged in space.

Author

Endocrine Systems; Infectious Diseases; Neurophysiology; Sleep; Sleep Deprivation; Endocrinology; Biological Effects; Human Reactions; Physiological Effects

20000029551 Fourth Military Medical Univ., Dept. of Aerospace Medicine, Xi'an, China

Effects of 24h - 6 deg. Head-Down Tilt Bed-Rest on Cardiovascular Function and Response to Orthostatic Stress

Yao, Yong-jie, Fourth Military Medical Univ., China; Wu, Xing-yu, Fourth Military Medical Univ., China; Sun, Xi-qing, Fourth Military Medical Univ., China; Hao, Wei-ya, Fourth Military Medical Univ., China; Wei, Ying-bo, Fourth Military Medical Univ., China; Cao, Zin-sheng, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 401-404; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study was to investigate the effects of 24 h - 6 degree head-down tilt bed-rest (HDT) on cardiovascular function and response to orthostatic stress. Six degree head-down tilt bed rest for 24 h in 6 healthy males, aged 22-23, were observed. The changes of cardiac function were observed by electrical impedance instrument before and at the 0, 6th, 12th, 18th and 24th hour of HDT, and blood pressure was recorded and urine samples were collected. The changes of cardiovascular response to head up tilt (HUT 90 degree, 10 min) before and post HDT were recorded. During HDT, HR reduced significantly when

compared that of pre-HDT(standing). HR at 6th, 12th, and 18 th hour of RDT reduced significantly than that at 0 hour of HDT. Stroke output (SO) and stroke index (CI) at 0th, 6th, 12th and 24th hour of HDT were higher than pre-HDT value. Cardiac output(CO) and cardiac index (CI) at 18 th hour of HDT were significantly lower than those at the beginning of HDT. Total peripheral resistance (TPR) at 18th hour of HDT were higher than that at the beginning of HDT. During HUT before and post HDT, HR, MBP, TPR were significantly increased, SV, SI, CO and CI were significantly reduced. DBP were significantly increased and PP were reduced significantly during HUT post-HDT. Hourly average value of urine during 0 through 4 h were higher than those during 4 through 12 h and 12 through 24 h. 24 h - 6 degree head-down tilt bed rest has significant effects on cardiovascular function and response to HUT in humans.

Author

Cardiovascular System; Heart Function; Physiological Responses; Head Down Tilt; Weightlessness Simulation; Hemodynamic Responses; Blood Circulation; Physiological Effects

20000029552 Naval Medical Research Inst., Shanghai, China

Changes and Its Measurements of Intracellular Ca^{2+} During Exposure to Hyperbaric Oxygen

Lei, Liu, Naval Medical Research Inst., China; Liu, Jing-chang, Naval Medical Research Inst., China; Lin, Shi-long, Naval Medical Research Inst., China; Li, Bin, Naval Medical Research Inst., China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 410-412; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study is to investigate the rule of change of intracellular Ca^{2+} and its measurement method during exposure to hyperbaric oxygen (HBO). The microfluorescence method was used to measure the changes of intracellular Ca^{2+} concentration in co-cultured endothelial cells (EC) and smooth muscle cells (SMC) in a specially designed miniature oxygen chamber. The results are summarized: (1) Ca^{2+} changes during HBO exposure can be clearly observed directly in the chamber; (2) Within 5 min during 0.2 MPa and 0.3 MPa HBO exposure, EC[Ca^{2+}] and SMC[Ca^{2+}] showed a tendency, to increase at first and then decrease with time throughout the exposures, especially the SMC[Ca^{2+}]. The EC ruptured under exposure to 0.4MPa HBO. During HBO exposure, EC[Ca^{2+}] and SMC[Ca^{2+}] showed biphasic changes, which increased at first and then decreased. The technique and method used were reliable and suitable for investigating of intracellular [Ca^{2+}] changes under HBO.

Author

Cells (Biology); Calcium; Endothelium; High Pressure Oxygen; Muscles

20000029555 Chinese Academy of Medical Sciences, Headquarters of General Equipment, Beijing, China

Progress in the Protective Medicine Against Rocket Propellants

Hu, Wen-xiang, Chinese Academy of Medical Sciences, China; Tan, Chong-yang, Chinese Academy of Medical Sciences, China; Tan, Sheng-jian, Chinese Academy of Medical Sciences, China; Jiang, Jian, Chinese Academy of Medical Sciences, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 451-454; In Chinese; Copyright; Avail: Issuing Activity

This article reviews the progress in the major assignment, the organization and implementation of protection against liquid rocket propellant. The safety detection methods of the rocket propellant in the launching field were also discussed. Three steps of the sanitation and protection of the liquid propellant, the toxicity and the toxicology of hydrazine on central nervous system, blood circulatory system, assimilation system, respiratory system, immune system, liver, kidney, eye, skin and its hereditary toxicology were described. In addition, the clinical types of poisoning, the current principle and the common ways of prevention and treatment of hydrazine and nitrogen oxides poisoning were summarized.

Author

Hydrazines; Nitrogen Oxides; Rocket Propellants; Safety; Sanitation; Toxicity; Toxicology; Toxic Hazards; Hazardous Materials; Protection

20000029556 Fourth Military Medical Univ., Dept. of Aerospace Medicine, Xi'an, China

Models for Altitude Decompression Sickness

Zhao, Min, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 446-450; In Chinese; Copyright; Avail: Issuing Activity

The objective is to study the probability or risk of decompression sickness in high altitude flight and to establish a probability model. Survival analysis technique was used in the analysis of the information about altitude decompression sickness. It was found that the risk of decompression sickness initially increases up to a certain time point, and then decreases because of denitrogenation. The hazard function may describe the characteristics of this pattern in changes of risk. The parameters of probability models for

altitude decompression sickness can be estimated by using the maximum likelihood method. Prediction with the survival models based on the logistic distribution is good.

Author

Decompression Sickness; High Altitude; Probability Theory; Altitude Sickness; Mathematical Models

20000029588 Institute of Space Medico-Engineering, Beijing, China

The Progress in Research on Changes of Central Venous Pressure Under Simulated Weightlessness and Microgravity

Wang, De-sheng, Institute of Space Medico-Engineering, China; Sun, Lei, Institute of Space Medico-Engineering, China; Xiang-Qui-lu, Institute of Space Medico-Engineering, China; Ren, Wei, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 459-462; In Chinese; Copyright; Avail: Issuing Activity

One of the most profound circulatory changes that occur in man during exposure to microgravity (microG) is a cephalad redistribution of fluid. Central venous pressure (CVP) is not only an important standard for determining the cephalad redistribution of fluid but also the unique valuable means for measuring continuously cardiac filling pressure under simulated weightlessness (SW) and microG, and has a relationship with neurohumoral regulation. With the development of manned spaceflight, the research in space suggested that CVP did not increase, which is directly contradictory to the previous results under SW. This paper mainly discusses the changes of CVP and the effects of countermeasures on CVP under SW and microG, and the mechanisms of decreased CVP under microG. It is postulated that more suitable SW models, more studies about the area of low pressure including especially pulmonary circulation, and comprehensive studies in multiple systems are needed.

Author

Blood Pressure; Microgravity; Pulmonary Circulation; Weightlessness Simulation; Blood Circulation

20000029605 Fourth Military Medical Univ., Faculty of Aviation Medicine, Xi'an, China

The Advances of the Research Work on Lens Cells Using Patch Clamp Technique

Meng, Qing-jun, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 456-458; In Chinese; Copyright; Avail: Issuing Activity

The study of lens cells by patch clamp technique began in the early 90's. It shows that the membrane of lens cells possess different types of ionic channels. These channels are responsible for the modulation of the hydration state and transparency of lenses. Several patch clamp configurations have been used to study the activity of ionic channels. The resting potential and capacitance as well as resistance of different lens cells were also measured. Key words: patch clamp technique; ion currents; vision disorders; crystalline lens

Author

Clamps; Lenses; Eye (Anatomy)

20000029609 Naval General Hospital, Beijing, China

Effects of High Temperature and Noise on Erythrocyte Membrane ATPase Activity in Pilots During Flight

Qin, Shi-zhen, Naval General Hospital, China; Yu, Qi-fu, Naval General Hospital, China; Ma, Gui-xi, Naval General Hospital, China; Hao, Wei-wei, Naval General Hospital, China; Li, ming-gao, Naval General Hospital, China; Zhao, Hong, Naval General Hospital, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 397-400; In English; Copyright; Avail: Issuing Activity

The objective of this study was to determine the effect of heat and noise on erythrocyte membrane ATPase activities in pilots during flying. Twenty-four pilots performing bombing for 3 h (45 to about 53 C, 122 to about 97dB in the cabin) served as the subjects. 21 ground personnel served as control (27 C in the room). Blood samples were taken from both groups before flying (6:00 a.m.), and immediately (12:00 a.m.) and 8 h (8:00 p.m.) after flying. Na⁺ - K⁺ ATPase, and Ca(2+) - Mg(2+) ATPase activities in erythrocyte membrane were determined with colorimetry. The Na⁺ - K⁺ ATPase activity in erythrocyte membrane at 6:00 a.m. in the pilots was higher than that in the control group at the same time (P is less than 0.01). The Ca(2+) - Mg(2+) ATPase activities in erythrocyte membrane at 12:00 a.m. and 8:00 p.m. in pilots were significantly higher, compared with those in control group at the same time (P is less than 0.01). The ATPase values obtained in our study were all within normal range, and the daytime variation of both groups are the same. Exposure of human body to heat and noise for long time may be harmful, the higher ATPase activity there is, the more there will be catabolism of ATP. ATP exhaustion will lead to Ca(2+) overload in erythrocytes thus stiffen the red cell membrane.

Author

Adenosine Triphosphate; Enzyme Activity; Erythrocytes; High Temperature; Temperature Effects; Noise (Sound); Flight Hazards

20000031354 Aeromedical Inst., Soesterberg, Netherlands

Sleep and Alertness Management during Military Operations: Review and Plan of Action *Final Report*

Simons, M.; Valk, P. J.; Nov. 1999; 47p; In English

Report No.(s): AD-A372731; Rept-1999-K5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Sleep and alertness management is a major point of attention for commanders and the medical support of military round the clock operations. Awareness on the effects of fatigue and sleepiness should be enhanced both on command level and crew level. Flight surgeons and safety officers should be trained to develop and implement mission specific crew endurance plans. Practical guidelines on methods to prevent serious fatigue and to enhance performance and alertness of the crew play a key role in these crew endurance plans. Useful methods include the use of strategic naps, hypnotics, stimulants, and chronobiotic treatment. In the context of the development of guidelines to optimize performance and alertness during sustained and stressful missions, this literature review describes the available knowledge and identifies areas where knowledge is lacking. In this context military relevant research issues related to the use of strategic naps, hypnotics, stimulants, and chronobiotic treatment are put forward. Based on the results of this study, a work program is drawn up, aimed at developing guidelines to optimize performance and alertness during sustained intensive 0 operations.

DTIC

Alertness; Sleep; Research and Development; Military Operations; Aerospace Medicine

20000031649 Battelle Pacific Northwest Labs., Richland, WA USA

Real-Time 3D Ultrasound for Physiological Monitoring 22258 *Annual Report, 15 Sep. 1998-14 Sep. 1999*

Littlefield, Richard J.; Oct. 1999; 65p; In English

Contract(s)/Grant(s): DAMD17-94-C-4127

Report No.(s): AD-A373262; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report documents the fourth and fifth years of an ongoing project to develop a prototype 3-D ultrasound telemedicine imaging system. During the first year of the reporting period (FY98), development of a motor driven linear-scan version of the MUSTPAC-2 ultrasound system was completed. One unit of this type has been placed at the National Naval Medical Center (Bethesda, MD) for evaluation in a clinical environment, and a second (ruggedized) unit was sent with the NASA/Yale Everest Extreme Expedition for testing at Mt. Everest Base Camp (elev 17,500 ft) . In addition, research and development was performed leading toward a freehand scan capability. In the second year of the reporting period (FY99), freehand scan capability was developed to a usable prototype level, and one unit of this type was placed at Georgetown University for evaluation. Efforts continued toward commercialization and routine use, resulting in a new project (at Mercy Hospital, Darby, PA), funded outside DARPA, to complete development of the freehand scan capability and obtain FDA 510(k) approval for MUSTPAC. Project DAMD17-94-C-4127 is essentially complete at this time, but is formally continuing under a no-cost time extension to allow NNMC further opportunity for their evaluation.

DTIC

Ultrasonics; Medical Services; Digital Systems; Clinical Medicine; Imaging Techniques; Telemedicine

20000031695 Fourth Military Medical Univ., Dept. of Aerospace Medicine, Xi'an, China

Computer Simulation of Cardiovascular Response to Lower Body Negative Pressure

Hao, Wei-ya, Fourth Military Medical Univ., China; Wu, Xing-yu, Fourth Military Medical Univ., China; Zhang, Li-fan, Fourth Military Medical Univ., China; Feng, Lin-hua, Fourth Military Medical Univ., China; Sun, Xi-qing, Fourth Military Medical Univ., China; Yao, Jong-jie, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 262-266; In Chinese; Copyright; Avail: Issuing Activity

To simulate the cardiovascular response to lower body negative pressure (LBNP). A computer model was developed. It had 7 subparts: the redistribution of blood, the filling of left ventricle, left ventricle, peripheral circulation, control of heart rate, control of peripheral resistance and control of venous tone. The heart rate and venous tone were controlled by high-pressure receptor baroreflex, while the peripheral resistance was controlled by high- and low-pressure receptor baroreflexes. With the help of the model, cardiovascular response to LBNP up to - 10. 64 kPa (- 80 mmHg) were simulated, including the changes of systolic blood pressure, mean blood pressure, heart rate and cardiac output. The time-dependent response to a LBNP profile was also simulated. The simulation results coincided well with human experiments. The model is valid and can accurately reproduce the short-term hemodynamic response to LBNP. Key words: mathematical model; cardiovascular system; lower body negative pressure; computerize simulation.

Author

Computerized Simulation; Cardiovascular System; Lower Body Negative Pressure; Systolic Pressure; Physiological Responses; Blood Pressure

20000031696 Fourth Military Medical Univ., Dept. of Aviation Medicine, Xi'an, China

Variation of Several Volume Regulating Hormones During 21 d - 6 deg Head -down Bed Rest

Cao, Xin-sheng, Fourth Military Medical Univ., China; Wu, Xing-yu, Fourth Military Medical Univ., China; Sun, Xi-qing, Fourth Military Medical Univ., China; Yao, Yong-jie, Fourth Military Medical Univ., China; Jiang, Chang-lin, Fourth Military Medical Univ., China; Jiang, Shi-zhong, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 258-261; In Chinese; Copyright; Avail: Issuing Activity

To investigate variations of plasma renin activity(PRA), aldosterone (Ald) and prostaglandin I₂ (PGI₂) during 21 d - 6 deg head-down tilt (HDT) with and without lower body negative pressure (LBNP). - 6 deg head-down tilt for 21 d were used to simulate weightlessness. 12 healthy male, aged 23. 7 +/- 5.0, were equally and randomly divided into control group (CON) and LBNP group. The latter subjected to LBNP (- 30 mm Hg, 1 h/d) in the last week of HDT. Samples of plasma were taken before HDT and on the 2 nd, 4 th, 11 th and 22 nd day during HDT. Compare to control levels, Ald declined significantly on the 2 nd (CON - 30 P less than 0.05; V. S. LBNP - 38 %, p less than 0.01) and increased significantly on the 11 th day(CON + 30 P less than 0.05; LBNP + 48 %, P less than 0.01).PRA reached peak value on the 4th day (P less than 0.05), and decline to below the control level on the 22 nd day. PGI₂ increased constantly during HDT, and increased significantly on the 22 nd day (CON P less than 0.01), 11 th, 22 nd (LBNP P less than 0.05). No apparent difference was found between groups after LBNP concerning PRA and Ald; and PGI₂ didn't increase further in LBNP group. HDT induced a timely increasing in PRA and Ald , constant increasing in PGI₂.

Author

Hormones; Weightlessness Simulation; Vasoconstrictor Drugs; Prostaglandins; Lower Body Negative Pressure

20000031700 Tongji Medical Univ., Inst. of Occupational Medicine, Wuhan, China

Biochemical Changes of Plasma in Paratroops Parachuting: A Preliminary Investigation

Wu, Tang-chun, Tongji Medical Univ., China; Xiong, Yi-li, Hankou Airplane Hospital, China; Chen, Sheng, Tongji Medical Univ., China; Leng, Shun-tang, Tongji Medical Univ., China; Tanguay, Robert M., Laval Univ., Canada; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 235-239; In English; Copyright; Avail: Issuing Activity

To study whether physiological and psychological stresses during parachuting jumps may result in biochemical changes of plasma in parachutists. Differences in the levels of hormones (cortisol, growth hormone, insulin, pancreatic glucagon, endothelin, angiotonin I and II, aldosterone), activities of enzymes (superoxide dismutase, glutathione peroxidase, glutathione S transferase), levels of the free radical damage indicator malondialdehyde (MDA), tumor necrosis factor alpha (TNF-alpha), and the main heat stress protein, HSP70, in the plasma and serum were investigated in control (non-parachuting) and parachuting paratroops. Significantly higher levels of serum hormones such as growth hormone, insulin, angiotonin I, renin activities, as well as NMA and plasma TNF-alpha and HSP70 were observed in the parachuting group. Whether these changes can potentially serve as useful biomarkers to assess possible abnormal stress in parachutists and to evaluate the health condition and to select parachutists remains to be further studied.

Author

Abnormalities; Biochemistry; Parachute Descent; Plasma Chemistry; Pathology; Physiology

20000031709 Institute of Space Medico-Engineering, Beijing, China

Thermodynamic analysis of saturation degree of O₂ in myoglobin and hemoglobin

Wu, Qing-cai, Institute of Space Medico-Engineering, China; Wang, Xian-min, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 298-302; In Chinese; Copyright; Avail: Issuing Activity

To analyze the saturation degree of O₂ in myoglobin and hemoglobin. Analysis is based on thermodynamic concepts such as Gibbs free energy, entropy, internal energy and so on. The analytical result were consistent with the results of experiments and analysis made by other authors. The thermodynamic method is feasible in analysing O₂ saturation degree in myoglobin and hemoglobin.

Author

Thermodynamics; Evaluation; Dioxides; Myoglobin; Internal Energy; Hemoglobin

20000031710 Shanghai Univ., Inst. of Bio-Medical Engineering, Shanghai, China

Telemedicine: Technology, Application, Evaluation and Prospect

Bao-hua, Wang, Shanghai Univ., China; He, Ping, Shanghai Univ., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 308-312; In Chinese; Copyright; Avail: Issuing Activity

With the information society drawing near, the pattern of medical treatment is changing. Telemedicine is now carrying out many purposes such as family health care, first aid, expert consultation, long-distance intervene and learning communication in its particular mode. This article will enter into some engineering-technology methods of medical information transmission (including data, sound and image), introduce several application field of telemedicine, evaluate the potential benefit, virtue and some problems which are likely to arise in the implement of telemedicine, and forecast the development of telemedicine in the future.

Author

Technology Utilization; Telemedicine; Data Transmission

20000031752 Institute of Space Medico-Engineering, Beijing, China

A Digital Simulation Study on the Effect of Change in Cardiovascular System Parameters on the Pulse Waveform of the Radial Artery

Kong, An., Institute of Space Medico-Engineering, China; Bai, Jing, Institute of Space Medico-Engineering, China; Zhang, Ju-peng, Institute of Space Medico-Engineering, China; Xi, Bao-shu, Institute of Space Medico, China; Zu, Pei-zhen, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 288-292; In Chinese; Copyright; Avail: Issuing Activity

To understand the effect of the change in cardiovascular system parameters on the pressure pulse waveform of the radial artery. A previously developed cardiovascular system mathematical model was used in this simulation study. The parameters used were heart rate, ventricular contractility, arterial compliance, peripheral resistance and blood viscosity. The change in each parameter would influence the pulse waveform. Most of the influences were in agreement with the results of clinical observations reported in the literature. However, several new phenomena were observed. The effect of change in single parameter on the pulse waveform was different for different combinations of other parameter values. It is suggested that the model is useful in studying the relationship between cardiovascular system parameters and pulse waveform of the radial artery.

Author

Research; Cardiovascular System; Arteries; Blood; Pressure Pulses; Digital Simulation

20000031772 American Health Foundation, Inc., Valhalla, NY USA

Development of Liquid Chromatography; Electrospray Ionization; Tandem Mass Spectrometry Methods for Determination of Urinary Metabolites of Benzene in Humans *Topical Report, Sep. 1994 - Oct. 1997*

Melikian, A. A.; Meng, M.; O'Connor, R.; Hu, P.; Thompson, S. M.; 1999; 60p; In English

Contract(s)/Grant(s): RFA 93-1

Report No.(s): PB2000-102981; HEI/RR-87/99; Copyright; Avail: National Technical Information Service (NTIS)

Occupational exposure to benzene is associated with the development of leukemia and other blood disorders; however, the effects of exposure to low levels of benzene are not well understood. In 1994, the Health Effects Institute (HEI) initiated a research program (the HEI Air Toxics Program) to address uncertainties in the health effects resulting from exposure to ambient levels of toxic air pollutants including benzene. One of the goals of this program was to develop and validate biomarkers of exposure to benzene. There are a number of challenges in identifying suitable markers of recent benzene exposure that are appropriate for epidemiologic studies. First, benzene can be metabolized along a number of different pathways, and some products of benzene metabolism can also be derived from the metabolism of other compounds. Second, data on benzene metabolism in humans are limited, particularly in response to low-dose exposures, and it has been difficult to extrapolate results of controlled exposure studies in animals to the human situation. Third, it is difficult to detect and measure reproducibly the low levels of many benzene metabolites. In response to these concerns, HEI funded Dr. Melikian and colleagues to develop and validate a novel, practical method for assaying metabolites of benzene in humans.

NTIS

Air Pollution; Liquid Chromatography; Ionization; Mass Spectroscopy; Urology; Metabolites; Benzene; Aerospace Medicine

20000031959 Institute of Space Medico-Engineering, Beijing, China

Analysis of Heart Rate Variability During Parallel Swinging

Li, Wei-Gang, Institute of Space Medico-Engineering, China; Yan, Xiao-Xia, Institute of Space Medico-Engineering, China; Pei, Jing-Chen, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 323-327; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to study the pilots' heart rate variability (HRV) characteristic before, during and after parallel swing and the possibility of evaluating vestibule-vegetative nervous reaction under linear acceleration. 37 healthy male pilots participated in

parallel swing test. Dynamic Electrocardiography (ECG) was recorded for 15 min before, during and after swing, using model MR-4500 Holter recorder. All spectra were estimated from 15 min HRV by autoregressive (AR) modeling method, the model order (8 - 15) was chosen using automatic program. The ratio of lower-frequency (LF) to high-frequency (HF) power of HRV spectrum (LF/HF) was computed. The relation between change of those ratios in different swing stage and swing time was analysed. Ratio of LF to HF during swing was markedly lower than those of before and after swing (P is less than 0.01). The vagal nervous activity was markedly increased during swing. There were complexity and versatility in the heart automatic nervous regulation before, during and after swing.

Author

Aerospace Medicine; Heart Rate; Variability

20000031960 Air Force General Hospital, Beijing, China

The Characteristics of Meniere's Disease in Aircrew

Xu, Xian-Rong, Air Force General Hospital, China; Liu, Hua-Feng, Air Force General Hospital, China; Guo, Li-Ying, Air Force General Hospital, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 368-370; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to study the characteristics of Meniere's disease in aircrew and its possible influence on space flight. Case studies of Meniere's disease were carried out in 22 pilots. There were vertigo (n = 22), tinnitus (n = 21), abnormal hearing (n = 19) and abnormal vestibular function (n = 11) in 22 pilots. Meniere's disease may hazard the flying in aviation or space and flying may further damage the inner ears of patients with Meniere's disease.

Author

Aerospace Medicine; Diseases; Flight Crews

20000031961 Fourth Military Medical Univ., Dept. of Aerospace Medicine, Xi'an, China

Mechanisms and Detection of G-Induced Loss of Consciousness

Yao, Yong-Jie, Fourth Military Medical Univ., China; Wu, Xing-Yu, Fourth Military Medical Univ., China; Sun, Xi-Qing, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 386-390; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

High sustained +Gz acceleration induced loss of consciousness (G-LOC) is the main factor that causes flying accident. This paper reviewed the mechanisms and its physiological detection. During slow onset rate (SOR) acceleration, cerebral ischemia/hypoxia are the mechanisms of G-LOC, during rapid onset rate (ROR) acceleration, G-LOC might be related to mechanical intracranial hypertension, but the direct experimental data were lacking. Arterial blood pressure of eye level and cerebral oxygen saturation are important among the physiological indices of G-LOC detection.

Author

Aerospace Medicine; Unconsciousness; Detection

20000031962 Institute of Space Medico-Engineering, Beijing, China

The Use of c-Fos Expression in Vestibular Function Investigation

Liu, Zhi-Qiang, Institute of Space Medico-Engineering, China; Pei, Jing-Chen, Institute of Space Medico-Engineering, China; Kan, Guang-Han, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 381-385; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

Certain forms of cellular activation lead to immediate early gene (IEGPs)transcription. The biochemical cascade involving IEGPs has been demonstrated to be an important part that cells response to environmental events. The article reviewed the feature of c-Fos expression in vestibular complexes under stimuli. It was considered that c-Fos expression might be a cue parameter in studying the connection of all vestibular complexes, and to reveal the mechanism of motion sickness.

Author

Aerospace Medicine; Vestibules

20000031963 Institute of Space Medico-Engineering, Beijing, China

Temperature Environment and the Heat Exchange of Astronaut in the Emergency Landing Areas

Wu, Qing-Cai, Institute of Space Medico-Engineering, China; Wang, Xian-Min, Institute of Space Medico-Engineering, China; Jiao, Shu-Jin, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 376-380; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to analyze the temperature environment of different emergency landing areas and discuss the heat exchange between astronaut and the temperature environment. In addition, countermeasures against the emergency temperature environment were discussed. Heat exchange equation between man and environment was built using the law of energy conservation, and factors that affect the heat balance of human body were discussed. It was found that temperature, humidity, air pressure, velocity of wind and solar radiation are factors affecting the thermal balance of the astronaut. It is important for an astronaut to act properly and use the living devices and the environment conditions correctly during the emergency landing.

Author

Aerospace Medicine; Temperature Measurement; Emergencies; Energy Transfer; Spacecraft Landing

20000031965 Institute of Space Medico-Engineering, Beijing, China

Effects of Extremity Cuffs as a Countermeasure Against the Cardiovascular Deconditioning During 21 d Head-Down Bedrest

Jiang, Shi-Zhong, Institute of Space Medico-Engineering, China; Jiang, Shi-Zhong, Institute of Space Medico-Engineering, China; Li, Jian-Jun, Institute of Space Medico-Engineering, China; Yao, Yong-Jie, Institute of Space Medico-Engineering, China; Wu, Xin-Yu, Institute of Space Medico-Engineering, China; Sun, Xi-Qing, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 364-367; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to affirm the protective effect of inflated cuffs. The protective effect against the cardiovascular deconditioning of inflated cuffs on the upper parts of thighs and arms during the 1st through 10th days of 21 d bedrest has been reported previously. The effect of the cuffs during the rest of the 21 d bedrest were studied in this paper. Five subjects in cuffs group whose orthostatic tolerance were well maintained continued bedrest for 7 d without inflated cuffs. For the last 4 days of this period, inflated cuffs were again applied. Orthostatic tolerance of subjects in cuffs group with and without cuffs were measured. Two of the five subjects suffered orthostatic intolerance on the 17th day. No sign of orthostatic intolerance were observed by the end of bedrest. (1) the cardiovascular deconditioning developed when inflated cuffs were not used, and (2) the use of inflated cuffs for 4 d improves the orthostatic tolerance.

Author

Cardiovascular System; Bed Rest; Cuffs; Deconditioning; Head Down Tilt; Aerospace Medicine

20000031974 Institute of Space Medico-Engineering, Beijing, China

Thermal Physiological Analysis of Man in an Intravehicular Activity Space Suit

Yu, Xue-Jun, Institute of Space Medico-Engineering, China; Chang, Shao-Yong, Institute of Space Medico-Engineering, China; Wu, Jian-Min, Institute of Space Medico-Engineering, China; Qiu, Man, Institute of Space Medico-Engineering, China; Wen, Ji-Fu, Institute of Space Medico-Engineering, China; Yang, Tian-De, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 356-359; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to analyze the thermal physiological changes of man in a Intravehicular Activity (IVA) space suit. Combined second design was used to arrange 24 tests in 6 young male subjects wearing an IVA space suit at sea level. The relationship between common thermal physiological measurements and air ventilating parameters (air temperature, flow rate and its relative humidity) together with metabolic state (rest or work) of man were established in mathematical models. Possible applications of these models were illustrated. Metabolic heat production which influences the relations was also discussed. Thermal physiological changes of man in the space suit were properly expressed by the mathematical models in this paper.

Author

Aerospace Medicine; Thermal Analysis; Physiology; Intravehicular Activity; Space Suits

20000031977 Chinese Air Force, East-Lake Sanatorium, Wuhan, China

Effects of Tea Polyphenols on Microcirculation and Antioxidation in Aircrew

Luo, Xin-Min, Chinese Air Force, China; Hu, Yong-Hun, Chinese Air Force, China; Yu, Jie, Chinese Air Force, China; Wang, Hong, Chinese Air Force, China; Xu, Qing-Yuan, Chinese Air Force, China; Zhan, Hao, Chinese Air Force, China; Space Medi-

cine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 338-341; In Chinese
Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to study the effects of tea polyphenols (TP) on bulbi conjunctiva microcirculation (BCM) and antioxidation in aircrew and find out the proper antioxidant for the health protection of aircrew. Forty healthy aircrew were divided into TP group (TP 600 mg/d. Po) and control group (placebo) randomly. The effects of TP on microcirculation and antioxidation in aircrew were tested after 20 days. Red blood cell (RBC) superoxide dismutase (SOD) activity and GSH - PX (Whole blood glutathione peroxidase)/MDA (serum malondialdehyde) ratio in TP group were significantly higher than those in control (P is less than 0.01), and serum MDA level was significantly decreased after TP administration (P is less than 0.05). The numbers of capillaries and blood flow in micrangium were significantly increased, RBC aggregation, ischemia area and A(arteriole)/V(venule) ratio were remarkably decreased in TP group (P is less than 0.01). The total integral value of microcirculation in TP group was Significantly reduced in comparison with that in the control group. TP can significantly increase the antioxidative ability of aircrew, decrease the BCM disturbance and improve the microcirculatory function.

Author

TEA Lasers; Phenols; Circulation; Antioxidants; Aerospace Medicine

20000031979 Institute of Space Medico-Engineering, Beijing, China

Changes in QT Interval of Electrocardiogram Under Gz(+) Acceleration and Its Significance

Wu, Bin, Institute of Space Medico-Engineering, China; Xie, Bao-Sheng, Institute of Space Medico-Engineering, China; Xue, Yue-Ying, Institute of Space Medico-Engineering, China; Lu, Sheng-Qiang, Institute of Space Medico-Engineering, China; You, Guang-Xing, Institute of Space Medico-Engineering, China; Liu, Xing-Hua, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 328-332; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to define whether QT interval could be used to predict the response of pilots to Gz(+) stress. 37 pilots underwent Gz(+4) acceleration on a human centrifuge. According to their responses to Gz(+) stress, subjects were divided into group A (good reaction group, n = 18), group B (hyperfunction reaction group, n = 14) and group C (inhibition reaction group, n = 1). QT and RR interval were measured pre -, during and post-G. The data of 33 subjects (89.2%) whose QT interval could be measured were analyzed statistically. During Gz(+), QT and RR interval were shortened and sensitivity of QT interval to RR interval was augmented significantly (vs. pre-G, P is less than 0.001); group B had higher sensitivity of QT interval to RR interval during + Gz (P is less than 0.001, as compared with group A); discrimination functions established by QT and RR interval during Gz(+) were efficient and their accurate judgement rate was 81.8%. The Changes in QT interval of Electrocardiogram (ECG) were related to autonomic nervous imbalance under Gz(+); QT interval and RR interval could be used to predict the response of pilots to Gz(+) stress. These suggested that the parameters and method in this study might be used in G-LOC warning system.

Author

Electrocardiography; Acceleration Stresses (Physiology); Intervals; Aerospace Medicine

20000032107 Boston Univ., Biomedical Engineering Dept., Boston, MA USA

Physiological Vibration and Resonance of LFS on the Respiratory System *Final Report, 1 Jul. 1997 - 31 Mar. 1999*

Jackson, Andrew C.; Nov. 29, 1999; 114p; In English

Contract(s)/Grant(s): N00014-97-1-0928

Report No.(s): AD-A373523; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

Model predictions of the effects of LFS on the human respiratory system suggested that pressures within airways can be greater than pressures applied to the body surface. In the current study, more physiologically and anatomically accurate human and rat lung models were developed to further study the consequences of LFS as well as to infer human lung behavior from measurements made in rats. The human model was also used to predict whether pressure amplification would be more significant in asthmatics by incorporating airway heterogeneity and broncho-constriction into the model. Pressure amplification was predicted to be reduced in asthmatics. A comparison between human and rat lung behavior indicated that resonances in rat lungs occur in human lungs at about one-tenth the frequency. Thus, the resonances predicted to occur in rat lungs at higher frequencies, i.e., 5,000 and 11,000 Hz, could produce pressure amplification in humans at much lower frequencies (i.e., 50-100 Hz). We are confident in the human model predictions since they compared very well with physiological measurements over a wide frequency range (2-2000 Hz). However, we have less confidence in the rat model since it could be validated only for a limited frequency range (20-80 Hz) due to the paucity of published rat data.

DTIC

Vibration; Respiratory System; Aerospace Medicine; Respiratory Physiology

20000032163 West China Univ. of Medical Sciences, Biomedical Engineering Dept., Chengdu, China

Circadian Rhythm of Gene Expression of Myocardial Contractile Protein, Left Ventricular Pressure and Contractility
Wang, Zheng-rong, West China Univ. of Medical Sciences, China; Wang, Ling, West China Univ. of Medical Sciences, China; Wan, Chao-min, West China Univ. of Medical Sciences, China; Cornelissen, Germaine, Minnesota Univ., USA; Anand, Inder, VA Medical Center, USA; Halberg, Franz, Minnesota Univ., USA; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 391-396; In English

Contract(s)/Grant(s): NSF 39-470193; Copyright; Avail: Issuing Activity

A number of cardiovascular variables exhibit a circadian rhythm. Whether myocardial contractile response and gene expression of the contractile protein also show changes with a similar period was investigated. Circadian variabilities in the left ventricular developed pressure (LVP) and contractility (LV dp/dt max) were measured in 24 Sprague-Dawley rats by directly left ventricular catheterizing and compared with changes in the gene expression of alpha-myosin heavy chain (alpha-MHC) in myocytes obtained from the same animals by dot blotting analysis. A circadian rhythm was seen in the variability of LVP (P is less than 0.001), LV dp/dt max (P is less than 0.001) and the biochemically measured expression of the alpha-MHC gene (Pis less than 0.01). As compared to the amplitude of the rhythm in alpha-MHC gene expression, the amplitude of the contractility rhythm was large (Pis less than 0.01) and the circadian amplitude of the LVP (Pis less than 0.001) was the largest, representing perhaps a composite of intracardiac plus any extracardiac contributions. One of factors which determines the circadian rhythm of myocardial contractile function is alpha-MHC gene expression level.

Author

Cardiovascular System; Circadian Rhythms; Gene Expression; Activity Cycles (Biology); Cardiac Ventricles

20000032389 Air Force Research Lab., Biodynamics and Acceleration Branch, Wright-Patterson AFB, OH USA

The AFRL Biodynamics Data Bank and Modeling Applications

Buhrman, John R., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 1-1 - 1-4; In English; See also 20000032388; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The Air Force Research Laboratory (AFRL) has studied the response of human volunteers and human surrogates to impact accelerations for over thirty years. The results of this research have been used to enhance the design of escape, crash protection, and life support systems, while providing invaluable biodynamic response data for the development and validation of impact simulation and injury models. The data that have been collected include accelerations, forces, and motions from in-house tests conducted on man-rated test facilities, including both a horizontal impulse accelerator and vertical deceleration tower. The test data and related summary information from these tests have been compiled and entered into a data bank residing on a server using MS Access, Excel, and Visual Basic software. The compilation of data and related software are referred to as the Biodynamics Data Bank (BDB). The contents of the BDB include general information describing the objective, test matrix, and results from seventy in-house test programs. Also included are the time history and peak biodynamic response data collected during these programs, encompassing approximately 5,000 impact tests. Anthropometry measurements from over 200 test subjects and bibliographic information from 10,000 related references are also included. Slow-motion videos of the tests are currently being digitized as AVI files for future entry into the BDB. Plans also include the scanning and subsequent entry of documentation photographs that will provide a visual image of each test set-up. to provide the user with more efficient access to the BDB, a test index has been developed which contains a complete list of all test parameters including the type of seat fixture, restraint system, and input acceleration profile. This index can be used to perform searches to create data sets of tests with specific parameters, thus enabling the researcher to address specific issues of interest. These features make the Biodynamics Data Bank an ideal source of test data for computer model development and validation.

Author

Anthropometry; Computerized Simulation; Biodynamics; Data Bases; Impact Tests; Impact Acceleration; Physiological Responses; Information Dissemination

20000032402 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada

A Model of Cardiovascular Performance During Sustained Acceleration

Walsh, C., Ryerson Polytechnic Univ., Canada; Cirovic, S., Toronto Univ., Canada; Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 14-1 - 14-9; In English; See also 20000032388

Report No.(s): DCIEM-98-P-XX; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

During aerial combat maneuvers, G(z) can cause visual impairment or loss of consciousness (G-LOC). Anti-G suits, positive pressure breathing, and anti-G straining maneuvers reduce the risk of G-LOC. However, complex G-profiles are problematic. to assist in designing G-protective measures for such profiles, we are developing a model of human cardiovascular performance.

We present preliminary results from a model that deals with the mechanical aspects of cardiovascular response to $G(z)$. Physiological reflexes are neglected. We consider a closed loop vascular network with a time varying elastance heart model. Blood flow is modeled by a one-dimensional (1-D) approximation: a pair of first order partial differential equations govern continuity and momentum. The blood pressure is determined by the external pressure and a tube law. The dominant physical phenomenon is wave propagation. The vasculature is modeled as a network of uniform flexible tubes. Valves are placed at the entrances and exits to the ventricles, and in the veins. The equations are solved numerically using a split coefficient matrix method. The algorithm is first order, and it is suited to wave propagation. The boundary conditions are implemented using the method of characteristics. The results show cardiac output falling as $G(z)$ increases and rising again when $G(z)$ is reduced. Because there are no physiological reflexes, the central arterial pressure rises and falls with cardiac output, rather than being regulated to its physiological value. G -suit inflation, during periods of high $G(z)$, returns the cardiac output to resting values when both the lower body and abdomen are covered. Protection is significantly reduced if only the lower body is covered. Simulations, in which Gz increases from 1G to 4G, are only plausible when there is at least one valve in the inferior vena cava.

Author

Cardiovascular System; Physiological Responses; Biological Models (Mathematics); Gravitational Effects; Protective Clothing; Safety Devices; Human Factors Engineering; Simulation

20000032403 Ryerson Polytechnic Univ., Dept. of Mechanical Engineering, Toronto, Ontario Canada

Effect of High +Gz Accelerations on the Left Ventricle

Behdinin, K., Ryerson Polytechnic Univ., Canada; Tabarrock, B., Victoria Univ., Canada; Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 15-1 - 15-9; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

During certain maneuvers, fighter pilots are subjected to high accelerations reaching 10g levels. The effect of this acceleration on the left ventricle is most severe when it is directed along the body z axis. Under such accelerations it is difficult for the heart to function and supply the body with blood and further more there is concern that the heart may suffer tissue tear as a result of high stresses on the heart tissue. In this study a detailed finite element analysis is carried out to determine the stress state of the left ventricle under high Gz loading. to develop the FE model, surface geometry data was acquired from view Point Data Lab in Utah. The surface data for the interior and the exterior of the left ventricle was then used with a software from XYZ Scientific Application Inc. of Livermore to develop a 3D FE model. The model is made up of 3830 solid elements with three layers between the inner and the outer surfaces. Finite element results for deflections, strains and stresses are obtained for a number of acceleration levels. The analysis accounts for geometric nonlinearities and uses the updated Lagrangian method in the MARC finite element program.

Author

Finite Element Method; Heart Function; Gravitational Effects; Human Body; Biological Models (Mathematics); Physiological Responses; Stress (Physiology); Aircraft Maneuvers

20000032404 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada

A Model of Cerebral Blood Flow During Sustained Acceleration

Cirovic, S., Toronto Univ., Canada; Walsh, C., Ryerson Polytechnic Univ., Canada; Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 16-1 - 16-7; In English; See also 20000032388

Report No.(s): DCIEM-98-P-XX; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Radial accelerations generated in modern combat aircraft maneuvers (Gz) may result in impaired vision or loss of consciousness (G -LOC). We are interested in developing mathematical models of cerebral blood flow during exposure to Gz . Our previous model showed that intracranial vascular resistance does not change with Gz since the vessels are protected from collapse by the cerebrospinal fluid and that reduction of the blood flow to the brain is mainly due to the increased vascular resistance of the large extracranial veins. Based on the previous results, we propose a model with simplified presentation of the arteries and intracranial vessels and a more detailed description of the jugular veins. The extracranial arteries are accounted for by the hydrostatic pressure drop from the heart to the head level. The intracranial vessels are represented by a resistance independent of the mechanical effects of Gz . However, a model of cerebral autoregulation is incorporated, which involves active change in the cranial vascular resistance in reaction to the change in blood pressure at the head level. The jugular veins are modeled using one dimensional equations of fluid dynamics and a non-linear relation between the transmural (blood minus external) pressure and the local vessel cross-sectional area. The central arterial and venous pressures are taken to be 105 mmHg and 5 mmHg respectively and Gz was varied from -5 to +10. to simulate the effects of positive pressure breathing, blood pressures at the arterial and venous ends of the model were elevated by the same amount, so that the perfusion pressure was always maintained at 100 mmHg. The model is successful in

reproducing the drop in cerebral blood flow with +Gz. This reinforces our belief that the elevated venous resistance plays a significant role in G-LOC. The autoregulation has a positive impact at moderate +Gz but is ineffective at higher +Gz. This is mainly due to the fact that the venous resistance becomes absolutely dominant at high +Gz and a further decrease in the cranial vascular resistance makes little difference. The model predicts an increase in the blood flow in the case when the central venous and arterial pressures are elevated. We attribute this to the fact that an elevated central venous pressure prevents the venous collapse and maintains the extracranial veins patent.

Author

Mathematical Models; Acceleration Stresses (Physiology); Aircraft Maneuvers; Blood Flow; Blood Pressure; Brain Circulation; Cardiovascular System

20000032405 Engineering Services, Inc., Toronto, Ontario Canada

Linear and Nonlinear Models of the Physiological Responses to Negative-to-Positive Gz Transitions

Kapps, A., Engineering Services, Inc., Canada; Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 18-1 - 18-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The identification and modeling of experimental data for negative-to-positive Gz (Push-Pull) transitions discussed in this paper is aimed at predicting typical and atypical physiological responses in order to develop Push-Pull countermeasures. A novel analysis of Push-Pull data in both the time and frequency domains was developed. Eye-level blood pressure dynamics in response to Push-Pull transitions differ significantly from subject to subject. This individual sensitivity is much less profound in a sub-group of the tested subjects. Overall, the match between the predicted and measured eye-level blood pressure is much better with low Gz gradients than in the case of large Gz gradients. A model with a transfer function of low order (3 by 3) may be sufficient to match the behavior of eye-level blood pressure under both Push-Pull and positive Gz maneuvers. However, nonlinear models are required to fit blood pressure response data in a sub-group of subjects.

Author

Computerized Simulation; Mathematical Models; Flight Crews; Acceleration Stresses (Physiology); Acceleration Tolerance; Aerospace Medicine; Gravitational Effects

20000032408 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada

A Physiological Data Analysis Toolbox for the Analysis of Acceleration Data

Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Askari, V., Engineering Services, Inc., Canada; Lu, Z., Engineering Services, Inc., Canada; Kapps, A., Engineering Services, Inc., Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 21-1 - 21-9; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

As an alternative to using traditional first principle-based modeling of a protected subject's physiological responses to real-life acceleration trains (both positive and negative-to-positive Gz transitions), a nontraditional systematic approach is being designed to facilitate the evaluation and prediction of human cardiovascular responses to G-suit and Positive Pressure Breathing (PPB) pressure schedules. The purpose of this work is to develop novel improved Anti-G protection schedules optimized for individual pilots in general and push-pull protection in particular. The proposed nontraditional systematic models are based on input-output relationships supplemented by expert knowledge. Therefore, both the experimental design and physiological data processing architecture are critical in this project. Six subjects (two females and four males) participated in the initial experimental effort. Persistently excited non-linear G-suit and PPB pressure schedules, which are not direct linear functions of Gz levels, have been applied using two types of electronic valves: (i) a combined Breathing Regulator and Anti-G valve (BRAG valve); and (ii) two custom-designed electronic (SAMCAV)- valves. The recorded parameters were heart level blood pressure, ECG, respiratory rate, G-suit and PPB pressures. Among other issues, this paper describes a Physiological Data Analysis Toolbox (Phi-DAT) that integrates statistical, fuzzy and linear trend investigations with higher-order spectrum analysis of the experimental data. -DAT has been designed as a preprocessor of the nontraditional systematic modeling architecture and proven very efficient in establishing correlation and trend dependencies between the non-linear pressure schedules employed and responses obtained.

Author

Physiological Responses; Acceleration Stresses (Physiology); Gravitational Physiology; Models; Computerized Simulation; Pressure Breathing; Pressure Suits; Flight Crews; Data Processing; Human Factors Engineering

20000032410 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA

Mathematical Models for Predicting Human Tolerance to Sustained Acceleration

Burton, Russell R., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 23-1 - 23-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Mathematical models that predict G-level and G-duration tolerances are reviewed. These model are subdivided into relaxed and straining tolerances. The latter tolerance predicts G levels of subjects that are performing an anti-G straining maneuver. These models are equations based on hydrostatic pressure mathematics $G = (P(a) * d)/h$. where: $G = +G$ level tolerance; $P(a)$ = mean arterial blood pressure in mm Ha (100) at heart level d = density of Hg (i.e. 13.6); and, h = vertical distance in mm (350 mm). The tolerance model is based on tolerance data obtained from subjects to the same continuous of G to fatigue. These G tolerance models were validated using published data. These G-level and duration models predict, with hugely accuracy, tolerances for relaxed or straining subjects using various anti-G protective systems/methods.

Author

Mathematical Models; Human Tolerances; Acceleration Stresses (Physiology); Human Factors Engineering; Acceleration Tolerance; Gravitational Effects

20000032411 BC Research, Inc., Vancouver, British Columbia Canada

A Biomechanical Approach to Evaluating the Health Effects of Repeated Mechanical Shocks

Morrison, J. B., Simon Fraser Univ., Canada; Robinson, D. G., BC Research, Inc., Canada; Nicol, J. J., BC Research, Inc., Canada; Roddan, G., BC Research, Inc., Canada; Martin, S. H., BC Research, Inc., Canada; Springer, M.-J.-N., BC Research, Inc., Canada; Cameron, B. J., BC Research, Inc., Canada; Albano, J. P., Army Aeromedical Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 24-1 - 24-8; In English; See also 20000032388 Contract(s)/Grant(s): DAMD17-91-C-1115; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Operators of industrial and military vehicles are routinely exposed to repeated mechanical shocks. Numerous studies have associated these exposures with an increased incidence of low back pain and degenerative disorders of the spine. This paper describes a method of evaluating the effect of repeated mechanical shocks on the health of vehicle operators. The method provides a health hazard assessment (HHA) in which the risk of injury to the operator is related to the acceleration measured at the vehicle seat. The HHA process consists of four stages. Dynamic response models are used to predict accelerations of the lumbar spine in the x, y and z axes from accelerations at the seat. Compressive forces at the L4/L5 vertebral joint are estimated from peak lumbar accelerations using relationships derived from biomechanical analysis. The effect of repeated compressive loading is calculated using a dose model based on the fatigue failure properties of tissue and the compressive strength of the vertebral joint. The risk of injury to the operator is then determined from the accumulated compressive dose, the fatigue life of the SyStem, the variance of vertebral joint strength data, and the cumulative probability of failure. The HHA model can be used to predict the risk of injury from a single exposure or from the cumulative effects of a lffe time. The HHA was tested using a range of repeated shock profiles. Results indicate that the risk of injury predicted by the HHA compares favorably with human tolerance data obtained from acute exposures and with injury incidence data obtained from chronic exposure of vehicle operators.

Author

Mechanical Shock; Biodynamics; Health; Human Tolerances; Human Factors Engineering; Occupational Diseases; Operational Hazards

20000032413 Institute for Human Factors TNO, Soesterberg, Netherlands

Modelling Motion Sickness

Bos, J. E., Institute for Human Factors TNO, Netherlands; Bles, W., Institute for Human Factors TNO, Netherlands; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 26-1 - 26-4; In English; See also 20000032388; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

To analyze and or anticipate air crew performance per- and post-flight, we present a model that predicts spatial orientation and motion sickness. We first demonstrate a close linkage between spatial orientation and motion sickness, resulting in the postulation that sickness only arises when sensed and expected estimates of gravity change differently. Including observer theoretical considerations, this concept lead to predictions of seasickness corresponding with experimental data. The model offers the possibility to predict all types of motion sickness, including simulator sickness.

Author

Models; Motion Sickness; Flight Crews; Acceleration Stresses (Physiology); Human Performance; Computerized Simulation

20000032414 Army Research Lab., Survivability/Lethality Analysis Directorate, Aberdeen Proving Ground, MD USA
New Methodology for the Assessment of Battlefield Insults and Injuries on the Performance of Army, Navy, and Air Force Military Tasks

Neades, David N., Army Research Lab., USA; Klopac, J. Terrence, Army Research Lab., USA; Davis, Edward G., Army Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 28-1 - 28-11; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

To address known limitations, shortfalls, and lack of a comprehensive standardized casualty assessment methodology, across the military services as well as within services, a new methodology has been developed for triservice use that allows the assessment of soldier performance following weapon-induced injury. This new methodology, embodied in the Operational Requirement-based Casualty Assessment (ORCA) modeling system, permits casualty assessments to be performed in a consistent manner across virtually all types of military platforms, jobs, and weapon-induced threats. The ORCA computer code enables the analyst to calculate anatomical damage and the effect on individual performance as a result of exposure to one or more insult types including kinetic energy (fragments), chemical, and blast overpressure. The ORCA modeling system incorporates previously developed as well as newly developed injury criteria models, algorithms, and scoring systems to characterize human bioresponse to trauma from various types of battlefield insults and derives estimates of soldier

Author

Injuries; Human Performance; Warfare; Computerized Simulation; Casualties

20000032415 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA

Dosimetry Models Used to Determine the Bioeffects of Directed Energy Exposure

Hurt, William D., Air Force Research Lab., USA; Mason, Patrick A., Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 29-1 - 29-7; In English; See also 20000032388

Contract(s)/Grant(s): F33615-90-C-0604; F41624-96-C-9009; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Determining the bioeffects of directed energy exposure is essential for establishing safety standards to protect military personnel and the general public. However, internal temperature measurements are invasive in nature, and therefore difficult or impossible to obtain. Furthermore, it would be unethical to expose human subjects to those field parameters producing substantial thermal increases. An alternative method to obtain the necessary information is the development of accurate anatomical models incorporating permittivity values for the major tissue types. Using the VisibleMan dataset available from the National Library of Medicine, we have converted each of the 1870 photographic images into a color-coded image representing permittivity values. Each color corresponds to an entry in a look-up-table containing the permittivity properties of that tissue. The resulting dataset is imported into a mathematical model to predict electrical fields and specific absorption rate (SAR) values. Various mathematical models are available including the finite-difference time-domain code. Processing such a large dataset is best accomplished using parallel computer system. Combining anatomical and mathematical models provide the technology required to begin understanding the distribution of localized SAR values in the human resulting from directed energy exposure.

Author

Dosimeters; Mathematical Models; Human Beings; Biological Effects; Electromagnetic Radiation; Radiation Dosage

20000032416 Veridian, San Antonio, TX USA

A Submodel for Combat Casualty Assessment of Ocular Injury from Lasers

Miller, R. E., II, Veridian, USA; Carver, B., Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 30-1 - 30-11; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In an effort to standardize casualty assessments for DoD, the Joint Service Technical Coordination Group/Munitions Effectiveness and Aircraft Survivability Crew Casualty Working Group (CCWG) developed the Operational Requirements based Casualty Assessment (ORCA) model. The ORCA system consists of a functioning software code that will predict the effects of insult-to-injury-to-operational casualty from various types of trauma at specific times post-insult. As an integral part of ORCA, this submodel was designed to predict the probability for ocular injury from insult on the battlefield by directed energy, i.e., lasers, and assess casualty status. A unique, integrated, and multifaceted approach was devised to compute the effects of laser insult on the elemental capabilities of vision, or visual taxons. The methodology is based on using equations and algorithms to calculate a functional index of ocular damage, utilizing this index to quantify the effects of combat injuries on the visual taxons, and applying the resultant values to a notional scale to determine the potential for combat casualty in terms of mission completion. This

submodel also provides a capability to differentiate operational casualties from medical casualties in a format that is compatible with the ORCA system.

Author

Casualties; Mathematical Models; Injuries; Human Performance; Combat; Eye (Anatomy)

20000032417 Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA

Burn Prediction Using BURNSIM and Clothing Models

Knox, F. S., Air Force Research Lab., USA; Reynolds, D. B., Wright State Univ., USA; Conklin, A., Veridian, USA; Perry, C. E., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 31-1 - 31-17; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The development of BURNSIM, an interactive burn prediction model, has been previously presented at SAFE. Recently, a user who was incorporating BURNSIM into a larger Crew Casualty Model (ORCA) came to us for documentation of BURNSIM's validation. This prompted us to pull together several previously unpublished studies of BURNSIM's ability to accurately predict both human and porcine (pig) burns. The paper discussed the degree to which BURNSIM's predictions agree with data published by: Stoll (human), University of Rochester Atomic Energy Project (pig), Fort Knox (human), Moritz and Henriques (pig), and Knox et al (pig). This paper adds to that discussion by introducing efforts to model the protective effects of clothing. Three approaches have been taken: first, making experimental observations of how much heat is transferred through fabric to a sensor or pig skin; second, treating clothing as a simple filter and finally, describing clothing analytically as a multi-layered system through which heat must flow. Each method has its uses and problems. For example, the analytical model is the most general but requires that the user specify many things about the clothing system e.g. size of spaces, thermal properties of the fabric etc. These are not often known and may be difficult to obtain. BURNSIM was able to predict with reasonable accuracy when the initial conditions and thermal inputs are adequately defined.

Author

Burns (Injuries); Computer Programs; Mathematical Models; Casualties; Protection; Predictions

20000032418 Royal Military Coll. of Science, Shrivenham, UK

Thermal Output of Pyrotechnic Compositions and Evaluation of Skin Burns

Lawton, B., Royal Military Coll. of Science, UK; Merrifield, R., Health and Safety Executive, UK; Wharton, R. K., Health and Safety Executive, UK; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 32-1 - 32-12; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents a method of computing the heat dose for first, second, and third-degree burns from convection or radiation sources. Henriques' theory of skin burns is used with a simple numerical model of one-dimensional, transient heat conduction through skin. Allowance is made, where necessary, for heat absorption due to penetration of the skin by short wavelength radiation. The theory is used to compute the quantity-distance-burns relation for fires burning various pyrotechnic compositions of commercial and military interest.

Author

Burns (Injuries); Pyrotechnics; Radiation Damage; Human Performance; Radiation Injuries; Skin (Anatomy); Conductive Heat Transfer; Radiation Dosage

20000032419 JAYCOR, San Diego, CA USA

Biomechanical Modeling of Injury from Blast Overpressure

Stuhmiller, James H., JAYCOR, USA; Masiello, Paul J., JAYCOR, USA; Ho, Kevin H., JAYCOR, USA; Mayorga, Maria A., Walter Reed Army Inst. of Research, USA; Lawless, Nancy, Walter Reed Army Inst. of Research, USA; Argyros, Greg, Walter Reed Army Inst. of Research, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 33-1 - 33-7; In English; See also 20000032388

Contract(s)/Grant(s): DAMD17-96-C-6007; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The loading of the body by blast overpressure, often generated by explosives or weapon noise, can rapidly collapse the air-containing organs of the body and cause local injury. These effects can range from isolated pathologies, with no observable physiological consequences, to rupture of critical organs and death. Following World War II, animal models were used to study lethality, while in the past two decades the US Army Medical Research and Materiel Command has used animal models to study injury. The lethality data was correlated with pressure-duration characteristics of the free field blast, but these correlations become ambiguous in reverberant environments. Correlations have been proposed based on the motion of the thorax, but without a biomechanical basis, they do not provide insight into injury location or scaling with species and gender. A model of the thoracic injury process has been developed that provides both a biomechanical understanding and a good correlation of experimental observation. This

paper reviews the mathematical model, the data supporting the choice of material properties, and the correlation of calculated internal stress with observed injury.

Author

Biodynamics; Blast Loads; Injuries; Mathematical Models; Pathology; Animals; Computerized Simulation; Explosives; Casualties

20000032420 Air Force Research Lab., HEPR, Brooks AFB, TX USA

Altitude Decompression Sickness (DCS) Risk Assessment Computer (ADRAC)

Petropoulos, L. J., Air Force Research Lab., USA; Kannan, N., Texas Univ., USA; Pilmanis, A. A., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 27-1 - 27-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Decompression sickness (DCS) is caused by exposure to significant reductions in environmental pressure. These situations are encountered during diving, high altitude exposures or artificially induced pressure changes in hyperbaric or hypobaric chambers. For large and rapid pressure reductions, supersaturation occurs as a result of the inability of tissue gas exchange processes to expel excess nitrogen. These gases, which come out of solution when tissues are sufficiently supersaturated, collect as bubbles in the tissue. The size and location of these bubbles are thought to have a significant effect on the resulting DCS symptoms. The risks can be minimized or prevented with sufficient denitrogenation by prebreathing pure oxygen before such exposures. The risk of DCS increases with extended exposure times, very high altitudes, and greater physical activity during the exposure. The assessment of DCS risk for both civilian and military personnel under specified flight protocols is a critical problem that the USAF deals with on a regular basis. To provide answers to these questions, and also to obtain a clearer understanding of the effects of denitrogenation, the High Altitude Protection Function of the Air Force Research Laboratory is developing an appropriate model to predict DCS risk using physical and physiological principles.

Author

Decompression Sickness; Models; Mathematical Models; Computerized Simulation; Human Factors Engineering; Physiological Responses

20000032687 Flugmedizinisches Inst. der Luftwaffe, Fuerstenfeldbruck, Germany

Physiological Consequences: Cardiopulmonary, Vestibular, and Sensory Aspects

Welsch, H., Flugmedizinisches Inst. der Luftwaffe, Germany; Albery, W., Air Force Research Lab., USA; Banks, R. D., Biodynamic Research Corp., USA; Bles, W., Institute for Human Factors TNO, Netherlands; Human Consequences of Agile Aircraft; March 2000, pp. 4 - 1 - 4 - 8; In English; See also 20000032683; Copyright Waived; Avail: CASI; A02, Hardcopy

Discussing the physiological consequences of enhanced fighter maneuverability (EFM), aspects of cardiopulmonary reactions will be seen during high G maneuvers, especially the combination of negative G-load followed by high G-onset maneuvers ("push-pull"). The aircrafts' capability to reach high altitude within a very short time (due to the lift to weight ratio of more than 1) may produce new problems even during normal aircraft operation, e.g. decompression sickness (DCS). The incidence of vestibular problems may be increased by unconventional acceleration exposures. Sensory stimulations may be induced by high acceleration alterations in the roll, pitch, and yaw axis. The support by an advanced G-protection garment will be needed. For the "care free" handling the advanced G-protection device must work without any delay in time even during high acceleration transitions, must secondly include high altitude protection, and thirdly must ensure pilot comfort. Furthermore special training devices are required such as the human centrifuge as a dynamic flight simulator (DFS) with a fully gimballed system, and a spatial (dis)orientation device with a fully three-axes gimballed system. Pilot selection and medical survey with high sophisticated diagnostic tools will become more and more important. Last not least the need of special physical training will be required to power, to train the cardiovascular reflexes, and to increase psychomotoric stability and mental mobility.

Author

Physiological Effects; Aircraft Maneuvers; Flight Characteristics; Flight Fatigue; Human Factors Engineering; Human Centrifuges; Gravitational Effects; Aircraft Pilots; Pilot Performance

20000032967 NASA Ames Research Center, Moffett Field, CA USA

Crew Factors in Flight Operations, 11, A Survey of Fatigue Factors in Regional Airline Operations

Co, Elizabeth L., San Jose State Univ., USA; Gregory, Kevin B., Sterling Software, Inc., USA; Johnson, Julie M., San Jose State Univ., USA; Rosekind, Mark R., NASA Ames Research Center, USA; October 1999; 44p; In English

Contract(s)/Grant(s): RTOP 548-30-32

Report No.(s): NASA/TM-1999-208799; IH-003; NAS 1.15:208799; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report is the eleventh in a series on the physiological effects of flight operations on flight crews. A 119-question survey was completed by 1,424 flight crewmembers from 26 regional carriers to identify factors contributing to fatigue in regional airline operations. Eighty-nine percent of crewmembers identified fatigue as a moderate or serious concern with 88% reporting that it was a common occurrence and 92% reporting that, when it occurs, fatigue represents a moderate or serious safety issue. However, 86% reported they received no company training addressing fatigue issues. Identified fatigue factors included multiple flight segments, scheduling considerations, varying regulations, and others. The two most commonly cited fatigue factors regarded flying multiple (more than four) segments. Scheduling factors accounted for nine of the ten most common recommendations to reduce fatigue in regional operations. Differing requirements among regulations were cited as contributing to fatigue. Other identified factors were the flight deck environment, automation, and diet. The data suggested specific recommendations, including education of industry personnel about fatigue issues and examination of scheduling practices. Education plays a critical role in any effort to address fatigue. Analyzing scheduling practices and identifying potential improvements may result in reduced fatigue as well as other benefits to operations.

Author

Physiological Effects; Flight Operations; Flight Crews; Human Performance; Mental Performance; Flight Fatigue; Flight Stress (Biology)

20000032987 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on UPS of a Totally Implantable Medical Device

Watanabe, Hiroyuki, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 221-222; In Japanese; Copyright; Avail: Issuing Activity

Transcutaneous energy transmission system (TETS) has been proposed to drive totally implantable medical devices such as an artificial heart. In the system, power is transcutaneously transmitted into the body, by making use of electromagnetic combination of two transcutaneous coils. A secondary power source is needed in case of missing power transmission from outside of the body. In this paper, an electric double layer capacitor (EDLC) is considered as the secondary power source. An EDLC can be charged and discharged with larger current and be cycled much more times compared to chemical batteries such as a Li-ionized or Ni-MH battery.

Author

Heart Implantation; Power Supplies; Capacitors

20000032990 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on Measurements and Analysis of Heart Wall Vibration using Ultrasound

Nakaya, Shigemitsu, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 215-216; In Japanese; Copyright; Avail: Issuing Activity

We have developed a novel method for accurately measuring the velocity signals on the multiple points preset on an ultrasonic beam in the heart wall by tracking the movement of the heart wall. In this paper, we control the directions of the ultrasonic beams so that the velocity signals are simultaneously measured at the multiple points on the surface of the left, ventricular (LV) wall. From these data, we estimate the spatial distribution of the eigen-vibration of the LV wall at the end-diastole. By applying the time-frequency analysis to the velocity signals of the heart wall, we determine the instantaneous eigen-frequency of the LV at end-diastole. From the eigen-frequency, the wall thickness, and the average radius of the LV, end-diastolic pressure and myocardial elasticity of the LV are noninvasively estimated.

Author

Diastolic Pressure; Elastic Properties; Heart; Ultrasonics; Vibration Measurement; Signal Measurement

20000032999 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Dynamics Analysis on Single Neuronal Activity During Sleep

Nakamura, Kazuhiro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 189-192; In Japanese; Copyright; Avail: Issuing Activity

Spontaneous single-unit activity during sleep was recorded from neurons in the region of the feline's lateral geniculate nucleus. The dynamical characteristics of the activity were analyzed for a time series of successive spike-counts measured within a fixed time-window. The results showed a white noise-like spectrum in the low frequency range, 0.04-1.0 Hz, during steady state non-REM sleep (slow-wave sleep), and a 1/f-noise, during REM sleep. We therefore did not reject our working hypothesis that neurons in the central processor systems of the brain have a transition in slow dynamics in their spontaneous activity between non-REM and REM sleep. Possible mechanisms underlying the transition in slow dynamics between non-REM and REM sleep are discussed in view of an alteration in neuronal interactions due to changes in the effects of aminergic/cholinergic modulations

of the brain during sleep. The functional meaning of the transition in slow dynamics during sleep is also discussed in view of the suppression and the reactivation of central excitatory networks during non-REM and REM sleep, respectively.

Author

Rapid Eye Movement State; Sleep; Dynamic Characteristics

20000033013 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Study on Development of Functional Electrical Stimulation System with 2-Dimensional Stimulus Data

Furuse, Norio, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 118-121; In Japanese; Copyright; Avail: Issuing Activity

EMG signals were measured during voluntary elbow flexion with different shoulder position maintained and with shoulder flexion controlled by an active orthosis. The EMG signals were compared mutually. The results suggested that 2-dimensional stimulus data was effective in functional electrical stimulation (FES) for controlling paralyzed upper extremities. A command input system using residual motor function for motor disabled patients was constructed, and the command input system was found to be applicable to the residual motor functions providing good performance of the FES system operation.

Author

Electromyography; Electric Stimuli; Signal Measurement

20000033014 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Generation of Optimal Stimulation for FES Standing up using Computer Model Simulation

Eom, Gwang-Moon, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 114-117; In English; Copyright; Avail: Issuing Activity

The most attention of this thesis was paid to the automatic generation of stimulation data for FES standing-up in paraplegic patients, to overcome the difficulties in the present EMG-based method. Automatic generation of "standard stimulation data" was selected as a first purpose of this thesis. At first, a simulation system of FES induced motion was developed. Musculotendon model in the system was simplified for application in the stimulation data generation. Standard stimulation data for unassisted standing was generated by dynamic optimization with the simulation system. The generated stimulation data were roughly in agreement with the normal subjects' EMG and the cost function was properly incorporated in it. From these, it may be said that the model-based method is useful for generating standard stimulation data. The same technique could be applied to generation of patient-specific stimulation data once the musculoskeletal system of a patient was properly identified. Therefore, a model and an identification scheme were developed. In the model, musculotendon and moment arm are lumped together resulting in a torque generator, which facilitated simple and noninvasive identification. A systematic protocol was developed for the identification. The model and its identification method were validated taking the vastus lateralis muscle at the knee joint as an example. The predicted joint angle trajectories closely matched the experimental data. This shows that the model was proper and the identification was successful. This also implies that the model-based generation of patient specific stimulation data is promising.

Author

Computerized Simulation; Musculoskeletal System; Electromyography; Mathematical Models; Paralysis; Stimulation; System Identification

20000033102 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

Measurement of Physiological and Psychological Condition in Human by Multiple Biosignals

Fukumoto, Takenori, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 343-344; In Japanese; Copyright; Avail: Issuing Activity

Evaluation of the physiological and psychological condition under stressing and relaxing stimulation is required when talking about environmental influence. We developed a system which can measure multiple biosignals in parallel and examined its validity by measuring multiple biomedical signals. Our results suggest that it is possible to evaluate the physiological and psychological condition under both stressing and relaxing stimulation by the developed system.

Author

Stress (Psychology); Stress (Physiology); Signal Processing; Stimulation

20000033262 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne Australia

Neural Network Training on Human Body Core Temperature Data

Sanders, Peter; Lau, Wai M.; Dec. 1999; 16p; In English

Report No.(s): AD-A373812; DSTO-TN-0241; DODA-AR-011-160; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A multi-layer Adaptive Linear Element neural network computer program was trained with back-propagation on physiological response data from nine subjects walking on a treadmill in two simulated tropical environments. The 100 minute end-point body core temperatures calculated were compared to the measured responses. It was found that although correlation was low and simultaneous high specificity and sensitivity were not displayed, the results were comparable to the predictions from an established human thermal response prediction programme for these subjects. It is concluded that the neural network modelling technique has merit in this field and should be explored further as more data become available.

DTIC

Human Body; Neural Nets; Aerospace Medicine; Body Temperature; Computer Programs

20000033305 Army Aeromedical Research Lab., Fort Rucker, AL USA

The Efficacy of Amphetamines for 64 Hours of Sustained Operations

Caldwell, John A., Army Aeromedical Research Lab., USA; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 2 - 1 - 2 - 8; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

Dextroamphetamine sulfate (Dexedrine(registered trademark)) is a powerful central nervous system (CNS) stimulant that improves alertness and postpones the need for sleep. In aviation, where a high degree of alertness is essential during long flights, dextroamphetamine can counteract the decreased vigilance and attention, slowed reaction time, negative psychological mood, and sometimes perceptual disturbances associated with severe fatigue. Countermeasures other than dextroamphetamine have been tested to overcome these problems, but the most popular strategy, that of emphasizing proper work/rest management, is almost impossible to successfully implement due to the unpredictability of combat operations. Other potential measures such as brief periods of exercise only temporarily reduce the negative impact of sleep loss, while exposure to cold air or noise is virtually ineffective or, in the case of loud music, actually deleterious. Improving the physical fitness of personnel likewise does little to reduce the impact of sleep loss.

Author

Amphetamines; Central Nervous System Stimulants; Alertness; Countermeasures

20000033306 Air Force Hospital (251th), Athens, Greece

Non Benzodiazepines Hypnotics: Another Way to Induce Sleep

Kodounis, Antonios, Air Force Hospital (251th), Greece; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 3 - 1 - 3 - 8; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The third generation hypnotics, zolpidem and zopiclone can be used to optimize rest periods during sustained operations and help the military personnel. This is possible because these drugs provide a good quality of sleep, without residual effects in the morning after administration. A literature review of the possible limitations of use of these drugs in pilots has been presented.

Author

Drugs; Personnel; Sleep; Hypnosis

20000033307 Dortmund Univ., Inst. for Occupational Physiology, Germany

The Effects of Low Frequency Electromagnetic Fields on the Melatonin Synthesis in Man

Griefahn, Barbara, Dortmund Univ., Germany; Degen, Gisela, Dortmund Univ., Germany; Blaszkewicz, Meinolf, Dortmund Univ., Germany; Golka, Klaus, Dortmund Univ., Germany; Kuenemund, Christa, Dortmund Univ., Germany; Their, Ricarda, Dortmund Univ., Germany; Griefahn, Barbara, Dortmund Univ., Germany; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 4 - 1 - 4 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

Some studies (mainly in rodents) have raised concerns regarding a carcinogenic potential of low-frequency electric and/or magnetic fields which may be related to the inhibition of melatonin synthesis. This hormone - isolated by Lerner et al. in 1958 [14] - is thought to exert an oncostatic effect probably by acting as a free radical scavenger [20, 21, 22]. The chronobiological properties of melatonin are much better founded. Melatonin mediates the entrainment (synchronization) of the periodic diurnal alterations of physiologic functions (core temperature, heart rates etc. [2, 4]). Moreover, melatonin has probably numerous other functions which are as yet insufficiently studied (thermoregulation, cardiovascular and immune functions etc.) [6, 7].

Author

Electromagnetic Fields; Low Frequencies; Thermoregulation; Synchronism

20000033309 Etat-Major de la Marine, Antenne Programmes, Toulon, France

Caffeine to Sustain Operational Fatigue

Sicard, B., Etat-Major de la Marine, France; Lagarde, D., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Batejat, D., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Chauffard, F., Nestle Research Centre, Switzerland; Enslin, M., Nestle Research Centre, Switzerland; Doireau, P., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Beaumont, M., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Tachon, P., Nestle Research Centre, Switzerland; Ballevre, O., Nestle Research Centre, Switzerland; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 6 - 1 - 6 - 3; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Sleep deprivation and desynchronization from circadian rhythm are common in military operation. Caffeine is the most widely used psychostimulant and may be useful in operational fatigue-coping strategies. In this paper we will review the current policies on caffeine in the military, then we will discuss effects and potential use of a slow release caffeine formulation.

Author

Caffeine; Sleep Deprivation; Military Operations; Circadian Rhythms

20000033312 Surrey Univ., School of Biological Sciences, Guildford, UK

Acute and Delayed Effects of Melatonin: Operational Significance

Arendt, Josephine, Surrey Univ., UK; Middleton, Benita, Surrey Univ., UK; Stone, Barbara, Defence Evaluation Research Agency, UK; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 9 - 1 - 9 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The primary function of melatonin in mammals is to convey information about the changing length of the night in the course of the year. Melatonin appears not to be essential for circadian organization but reinforces functions associated with darkness. In diurnal humans this of course included sleep and lowered body temperature. It may act as an adjunct to light for the maintenance of synchrony with the solar day. Exogenous melatonin can both advance and delay the timing of sleep and other circadian functions and appears to stabilise sleep to a 24h period taken daily at an appropriate time in free running conditions. However there is at yet little evidence that it can consistently synchronise free running strongly endogenous variables such as core temperature. Its effects on sleep in free run are complex, depend on circadian time of administration, and in part can be interpreted on a photoperiodic basis.

Author

Diurnal Variations; Circadian Rhythms; Sleep

53

BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20000027409 NASA Johnson Space Center, Houston, TX USA

Crew Skills and Training

Jones, Thomas, NASA Johnson Space Center, USA; Burbank, Daniel C., NASA Johnson Space Center, USA; Eppler, Dean, NASA Johnson Space Center, USA; Garrison, Robert, California Univ., USA; Harvey, Ralph, Case Western Reserve Univ., USA; Hoffman, Paul, Harvard Univ., USA; Schmitt, Harrison; Mars Field Geology, Biology. and Paleontology Workshop: Summary and Recommendations; [1998], pp. 25-30; In English; See also 20000027406; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

One of the major focus points for the workshop was the topic of crew skills and training necessary for the Mars surface mission. Discussions centered on the mix of scientific skills necessary to accomplish the proposed scientific goals, and the training environment that can bring the ground and flight teams to readiness. Subsequent discussion resulted in recommendations for specific steps to begin the process of training an experienced Mars exploration team.

Author

Mars Exploration; Mars Surface; Manned Mars Missions; Mars (Planet); Astronauts; Astronaut Training; Qualifications; Mission Planning; Abilities

20000027679 Psychometrix Associates, Inc., Lincoln, MA USA

ABAIS: Affect and Belief Adaptive Interface System *Final Report, Mar. 1998 - Feb. 1999*

Hudlicka, Eva, Psychometrix Associates, Inc., USA; Billingsley, John, Psychometrix Associates, Inc., USA; Feb. 1999; 156p; In English

Contract(s)/Grant(s): F41624-98-C-5032; AF Proj. 3005

Report No.(s): AD-A373270; AFRL-HE-WP-TR-1999-0169; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

We describe an Affect and Belief Adaptive Interface System (ABAIS) designed to compensate for performance biases caused by users' affective states and active beliefs. The ABMS architecture implements an adaptive methodology consisting of four steps: sensing/infering user affective state and performance relevant beliefs; identifying their potential impact on performance; selecting a compensatory strategy; and implementing this strategy in terms of specific GUI adaptations. ABAIS provides a generic adaptive framework for exploring a variety of user assessment methods (e.g., knowledge based, self reports, diagnostic tasks, physiological sensing), and GUI adaptation strategies (e.g., content and format based). The ABAIS performance bias prediction is based on empirical findings from emotion research, and knowledge of specific task requirements. The initial ABAIS prototype is demonstrated in the context of an Air Force combat task, uses a knowledge based approach to assess the pilot's anxiety level, and modifies selected cockpit instrument displays in response to detected increases in anxiety levels.

DTIC

Performance Prediction; Physiological Responses; Human Factors Engineering; Decision Support Systems; Adaptation; Combat; Display Devices

20000029471 Massachusetts Inst. of Tech., Cambridge, MA USA

Principal Investigator-in-a-Box

Young, Laurence R., Massachusetts Inst. of Tech., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-43 - B-44; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Human performance in orbit is currently limited by several factors beyond the intrinsic awkwardness of motor control in weightlessness. Cognitive functioning can be affected by such factors as cumulative sleep loss, stress and the psychological effects of long-duration small-group isolation. When an astronaut operates a scientific experiment, the performance decrement associated with such factors can lead to lost or poor quality data and even the total loss of a scientific objective, at great cost to the sponsors and to the dismay of the Principal Investigator. In long-duration flights, as anticipated on the International Space Station and on any planetary exploration, the experimental model is further complicated by long delays between training and experiment, and the large number of experiments each crew member must perform. Although no documented studies have been published on the subject, astronauts report that an unusually large number of simple errors are made in space. Whether a result of the effects of microgravity, accumulated fatigue, stress or other factors, this pattern of increased error supports the need for a computerized decision-making aid for astronauts performing experiments. Artificial intelligence and expert systems might serve as powerful tools for assisting experiments in space. Those conducting space experiments typically need assistance exactly when the planned checklist does not apply. Expert systems, which use bits of human knowledge and human methods to respond appropriately to unusual situations, have a flexibility that is highly desirable in circumstances where an invariably predictable course of action/response does not exist. Frequently the human expert on the ground is unavailable, lacking the latest information, or not consulted by the astronaut conducting the experiment. In response to these issues, we have developed "Principal Investigator-in-a-Box," or [PI], to capture the reasoning process of the real expert, the Principal Investigator, and combine that with real-time data available in space in order to advise the astronaut about how to proceed in real time. [PI] advises the astronaut during the progress of an experiment in much the same way a real Principal Investigator might do while looking over the astronaut's shoulder. In its original application, [PI] mimicked several of the tasks of the Principal Investigator, including data quality monitoring, troubleshooting, prescheduling, protocol management and "interesting data" detection. The proposed research focuses on the efficacy of this technique as applied to the data quality monitoring and troubleshooting aspects of [PI].

Author

Artificial Intelligence; Expert Systems; Human Performance; Psychological Effects; Real Time Operation

20000031651 South Carolina Univ., Columbia, SC USA

Contributions to the Development of VE-Assisted Training of Spatial Behavior *Final Report, 15 Jun. 1999-14 Jan. 2000*

Allen, Gary L.; Feb. 01, 2000; 24p; In English

Contract(s)/Grant(s): N00014-99-1-0928

Report No.(s): AD-A373202; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A conceptual analysis for identifying essential spatial skills concluded that three functional families of skills can be identified (object identification, wayfinding and orientation, and target interception/interception avoidance) and that current VE technology

is sufficient for their assessment and training. An empirical study of frame of reference control indicated that global and local object frames of reference were more effective than mobile object based and observer based frames in fixed observer situations. An empirical study of distance estimation training showed that skill in estimating metric distance can be trained in the field using either verbal or visual feedback and transferred to a novel field setting.

DTIC

Virtual Reality; Spatial Distribution; Perception; Verbal Communication

20000031731 China Southwest Airlines, Dept. of Steward Medicine, Chengdu, China

Effects of Acute Mild and Moderate Hypoxia on Human Short Memory

Du, Jian-ying, China Southwest Airlines, China; Zhuang, Yong, China Southwest Airlines, China; Li, Xue-yi, China Southwest Airlines, China; Wu, Xing-yu, China Southwest Airlines, China; Wang, Tao, China Southwest Airlines, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 270-271; In Chinese; Copyright; Avail: Issuing Activity

To investigate the effects of acute mild and moderate hypoxia on human short memory. Tests of pattern memory, scanning memory, continuous recognition memory and space memory were conducted on 18 healthy young male subjects during exposure to 300 m(control), 2800 m, 3600 m and 4400 m altitude in hypobaric chamber. Compared to control group, only the performance of continuous recognition memory decreased significantly after exposure to 2800 m for 1 h (P less than 0.05); total reaction time in all tests increased significantly (P less than 0.01) and performance decreased after exposure to 3600 m for 1 h, but the error rates in memory scanning and space memory test were unchanged (P greater than 0.05); during exposure to 4400 m performance of all tests decreased further to about 90.4 %, 93.7 %, 83.3 % and 80.7 % of the control values (P less than 0.01), respectively, and error rate increased significantly too (P less than 0.05). Performance of human short memory decreased after exposure to acute mild and moderate hypoxia for 1 h, and these effects were aggravated with the increase of altitude. Characteristic and threshold of the effect on the various performance tests were different, but increase of reaction time was the first to appear in all cases.

Author

Hypoxia; Males; Memory; Performance Tests; Reaction Time; Altitude Simulation

20000031947 Army Aeromedical Research Lab., Fort Rucker, AL USA

Spatial Disorientation Demonstration Flight for U.S. Army Aviators in the TH-67, UH-1, and UH-60 Helicopters *Final Report*

Estrada, Arthur; Braithwaite, Malcolm G.; Hoffman, Siobhan M.; LeDuc, Patricia A.; Jan. 2000; 71p; In English

Report No.(s): AD-A373633; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Spatial disorientation (SD) occurs when a pilot misperceives the position, motion, or attitude of his or her aircraft. In wartime, the risk of SD is heightened by the extra pressure on sensory and cognitive resources. During Operation Desert Shield/Storm, 81 percent of U.S. Army aviation nighttime accidents were ascribed to SD. An important countermeasure to SD is the aviator's awareness of his physiological vulnerability to SD and the circumstances in which SD is most likely to occur. Consequently, all military aviators must attend courses of instruction in SD. Most student pilots are given instruction during their flight training on how to overcome the effects of SD, but few air services provide a specific SD demonstration sortie to augment ground-based training. An in-flight demonstration of SD reinforces knowledge of the limitations of the orientation senses in flight and enhances aircrew awareness of potentially disorientating situations. Due to anticipated funding and asset changes at the U.S. Army Aviation Center (USAAVNC), Fort Rucker, Alabama, flight training may be affected and undergo revision. In an effort to be responsive to future training requirements and as the developer of this SD flight training, USAARL is publishing this report containing the SD demonstration flight lesson plans for the TH-67, UH-1, and UH-60 helicopters.

DTIC

Disorientation; Spatial Distribution; UH-1 Helicopter; UH-60A Helicopter; Aircraft Pilots; Sensory Perception

20000032299 North Carolina Agricultural and Technical State Univ., Greensboro, NC USA

Effects of Personality and Gender on a Simulated Flight Task

Strickland, D., North Carolina Agricultural and Technical State Univ., USA; Johnson-Dunnings, H., North Carolina Agricultural and Technical State Univ., USA; Wright, S., North Carolina Agricultural and Technical State Univ., USA; Ntuen, C., North Carolina Agricultural and Technical State Univ., USA; Portalatin, M., North Carolina Agricultural and Technical State Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 263-268; In English; See also 20000032189 Report No.(s): 98URC048; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

Traditionally, studies in the area of human factors and supervisory control have focused on the perception and cognitive aspects of the controller in the system. This research was conducted to determine possible effects of personality and gender on an individual's ability to respond to the system, as well as the individual's perception of workload. For this study, a flight simulation prototype with five separate gauges was created to act as the system. Potential participants between the ages of 17 and 30 were given questionnaires to determine whether they were one of the following personality types: Introvert/Extroverts or Type A/Type B. Based on their responses to the questionnaires, five individuals of each personality type were chosen to participate in the testing (10 males and 10 females). They were exposed to two 30 minute simulated flight sessions, during which time they monitored the gauges for automation failure. Response times to failures were collected and analyzed using analysis of variance. Each participant also filled out workload surveys to determine his/her perceived workload for each session. Statistical analysis indicated significant differences (at an alpha level of 0.05) in response times and workload measures based on gender and personality, as well as the interaction of the two variables. Further research using more subjects is recommended to validate results obtained. Validation may lead to changes in pilot training programs.

Author

Flight Simulation; Human Factors Engineering; Personality; Females; Males; Flight Crews

20000032628 Minnesota Univ., Dept. of Computer Science, Minneapolis, MN USA

Automatic Detection of Driver Fatigue, Phase 3 Final Report, 1998-1999

Kaur, S. S.; Eriksson, M.; Papanikolopoulos, N. P.; Jun. 1999; 54p; In English

Report No.(s): PB2000-100636; MN/RC-1999-30; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Sleep deprivation and sleep disorder continues to cause problems on the road. Reducing the number of accidents related to driver fatigue would save the society a significant amount of money and personal suffering. Monitoring the driver's symptoms can help determine driver fatigue early enough to prevent accidents due to lack of awareness. The report describes advances towards a non-intrusive approach for real-time detection of driver fatigue. It uses a video camera that points directly toward the driver's face and monitors the driver's eye to deter micro-sleeps, or short periods of sleep of about three-to-four seconds.

NTIS

Detection; Fatigue (Biology); Human Performance

20000032670 Brigham and Women's Hospital, Boston, MA USA

The Deployment of Visual Attention: Two Surprises

Wolfe, Jeremy M.; Search and Target Acquisition; March 2000, pp. 20-1 - 20-11; In English; See also 20000032651; Copyright Waived; Avail: CASI; A03, Hardcopy

The visual system is not capable of processing of all aspects of a scene in parallel. While some visual information can be extracted from all locations at once, other processes, including object recognition, are severely limited in their capacity. Selective attention is used to limit the operation of these limited-capacity processes to one (or, perhaps, a few) objects at a time. Searching for a target in a scene, therefore, requires deployment of attention from one candidate target to the next until the target is found or the search is abandoned. Common-sense suggests that distractor objects that have been rejected as targets are marked in some fashion to prevent redeployment of attention to non-target items. Introspection suggests that sustained attention to a scene builds up a perception of that scene in which more and more objects are simultaneously recognized. Neither common-sense nor introspection are correct in this case. Evidence suggests that covert attention is deployed at random among candidate targets without regard to the prior history of the search. Rejected distractors are not marked during a search. Prior to the arrival of attention, visual features are loosely bundled into objects. Attention is required to bind features into a recognizable object. For an object to be recognized, there must be a link between a visual representation and a representation in memory. Our data suggest that only one such link can be maintained at one moment in time. Hence, counter to introspection, only one object is recognized at one time. These surprising limits on our abilities may be based on a trade off speed for apparent efficiency.

Author

Visual Perception; Target Recognition; Visual Observation; Position (Location); Pattern Recognition; Mental Performance

20000032672 Army Research Lab., White Sands Missile Range, NM USA

Depth Perception Applied to Search and Target Acquisition

Watkins, Wendell R., Army Research Lab., USA; Alaways, LeRoy, Military Academy, USA; Search and Target Acquisition; March 2000, pp. 22-1 - 22-11; In English; See also 20000032651; Copyright Waived; Avail: CASI; A03, Hardcopy

A search and target acquisition test was performed under an exchange scientist program with the TNO Human Factors Research Institute at Soesterberg, The Netherlands in September 1998. The test was performed at a military training base using several of the scientists from TNO wearing Dutch forest camouflage uniforms. Sets of wide baseline stereo photos were obtained

for targeted and non-targeted scenes at two sites. The targeted and non-targeted scene photos were taken on the same day within a few minutes of each other. The imagery obtained was taken with a 35 mm camera with a 200 mm lens for target ranges from 100 m to 1 km. A single field of view was used for all of the targeted and non-targeted scenes at each site. The photos were taken with color slide film and were digitized to 3K by 2K pixel resolution. These imagery data sets were used to perform search and target acquisition tests. Preliminary analysis of single line of sight search and target acquisition observer tasks was performed for the same scenes with and without targets. Results of these observer tests are presented. Additionally, the scenes used in these tests were made into stereo pair images for observer display. There are several aspects to the display of wide baseline stereo images that must be taken into consideration for optimum depth perception for use in search and target acquisition. Rule of thumb guidelines for optimizing the depth perception of the contour of camouflaged targets versus terrain features have been derived.

Author

Space Perception; Target Acquisition; Camouflage; Photographs; Target Recognition; Stereoscopic Vision; Visual Discrimination; Visual Observation

20000032686 Institut de Medicine Aerospatiale Armee, Dept. Sciences Cognitives, Bretigny sur Orge, France
Psychological Consequences and Pilot "Situational Awareness" Survey

Grau, J. Y., Institut de Medicine Aerospatiale Armee, France; Human Consequences of Agile Aircraft; March 2000, pp. 3 - 1 - 3 - 15; In English; See also 20000032683; Copyright Waived; Avail: CASI; A03, Hardcopy

The technological design and developments already applied to a number of aircraft, which represent the basis of tomorrow's aircraft, tend to change the tasks performed by pilots. Since the 80's, automation and computerization have invaded cockpits, leading to a change in the role of pilots. Whereas pilots used to need competencies directed towards handling and navigating the aircraft, what is now increasingly required of them is the ability to manage complex systems. With the arrival of new concepts like supermaneuverability and superagility, it seems extremely important to try and understand the psychological consequences these concepts will have on pilots. Enabling new types of operation, supermaneuverability and superagility alter existing tasks and will probably create new ones, which will have their own psychological constraints. What makes these constraints different from those existing on present aircraft, and what consequences could they have on pilot performance? These two questions can be addressed by two preliminary comments: (1) As of today, supermaneuverability and superagility are still extremely novel concepts. Various "prototype" aircraft point to the developments, which will eventually make these concepts a reality in the near future, but there still is no such thing as "real" operational experience. The difficulty in accurately studying the consequences these future aircraft will have on pilots, lies in trying to define the exact role the pilot will be asked to play aboard. (2) The psychological consequences studied in this chapter will be limited to the consequences borne by the pilot in terms of taking and processing information. This chapter does not take into account psychological aspects based on personality or motivation.

Derived from text

Aircraft Pilots; Human-Computer Interface; Pilot Performance; Flight Fatigue; Stress Analysis; Human Factors Engineering

20000032689 Swedish Air Force, Aeromedical Center, Stockholm, Sweden
Selection, Training and Simulation

Linder, Jan, Swedish Air Force, Sweden; Tielemans, W., Swedish Air Force, Sweden; Albery, W., Swedish Air Force, Sweden; Human Consequences of Agile Aircraft; March 2000, pp. 6 - 1 - 6 - 10; In English; See also 20000032683; Copyright Waived; Avail: CASI; A02, Hardcopy

In this paper a "superagility training structure" has been discussed and proposed. The super agile pilot will in the new super-agility arena be clearly dependent on both old training principles but also on training where some new interacting factors might come into play: (1) At first Selection plays a major role with physiological, intellectual and stress management resources; (2) Certain human constraints like musculoskeletal, cardiovascular, respiratory, sensory and mental are discussed; (3) Normal life and regular training where almost everything the pilot does also have a definite implication also on flying; (4) Specific single task training where a pilot trains crucial abilities like G-tolerance, back/neck tolerance and so on. Today there is a lack in this area of specific training. There is also a need for training devices for pilots regarding the sensory system and the cognitive performance; (5) Specific combined tasks training where the pilot have to train in a more complex way, e.g. survival training or mission scenarios in a Multi Mission Trainer (MMT); and (6) Full ground mission task where the pilot uses a Full Mission Simulator (FMS) or a Dynamic Flight Simulator (DFS). Some parts of the Superagility Training Structure have not been a scope of this paper. They are Basic flying and Tactical/operational flying.

Derived from text

Pilot Selection; Physiological Tests; Flight Simulation; Pilot Training; Human Factors Engineering; Flight Fatigue; Flight Stress (Biology); Pilot Performance

20000033304 Institut de Medicine Aerospatiale Armee, Bretigny sur Orge, France

The Use of Modafinil in Operational Settings: Individual Differences Implications

LaGarde, Didier, Institut de Medicine Aerospatiale Armee, France; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 1 - 1 - 1 - 4; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Disruptions in wake-sleep rhythms, particularly induced by SUSOPS and CONOPS, are limiting factors for military personnel in operation. Pharmacological aids, such as hypnotic or stimulant substances can be effective countermeasures. Modafinil (MODIODAL PROVIGIL is a synthetic molecule prescribed for the treatment of narcolepsia and idiopathic hypersomnia. The wakening effect is potent : modafinil allows healthy volunteers to stay awake and efficient for more than 60 hours, without side effects. Its mechanism of action is complex, and it could induce wakefulness by different mechanisms., as compared with other classical vigilance enhancing drugs such as amphetamines. A neuroprotective effect against neurotoxic organophosphate agents was recently discovered. Modafinil seems to be a powerful and safe countermeasure in the management of sleep-wake rhythm during operational situations.

Author

Military Operations; Amphetamines; Organic Phosphorus Compounds; Personnel

20000033308 Defence Evaluation Research Agency, Protection and Performance Dept., Farnborough, UK

Promoting Sleep: Adapting to Shiftwork and Time Zone Change

Stone, Barbara M., Defence Evaluation Research Agency, UK; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 5 - 1 - 5 - 11; In English; See also 20000033303; Copyright Waived; Avail: CASI; A03, Hardcopy

The changes in performance that arise in shiftworkers and after transmeridian flights can be attributed, at least in part, to the reduction in both the quality and quantity of sleep which occurs as a result of disruption of the normal pattern of sleep and wakefulness. Sleep disturbance associated with shiftwork is well documented (1-4). Sleep during the day is shorter and more disturbed than sleep at night, and it has been estimated that, by the end of a week of night duty, the equivalent of at least one night's sleep may have been lost (5). While the duration of slow-wave sleep is unchanged following the night shift, due to prior wakefulness, stage 2 and rapid eye movement (REM) sleep are reduced. Further, in shiftworkers over about 40 years old, the usual decline in sleep quality and quantity with increasing age exacerbates the problems associated with an unusual pattern of work and rest (6-8). This age-related difference in sleep is also evident in studies of transmeridian travel (9).

Author

Sleep; Sleep Deprivation; Wakefulness

20000033310 Institute for Human Factors TNO, Soesterberg, Netherlands

The Effects of Tyrosine on Cognitive Functions during Sustained Operations

Wientjes, Cornelis J. E., Institute for Human Factors TNO, Netherlands; Deijen, J. Berend, Vrije Univ., Netherlands; Vullings, Huub F. M., Royal Netherlands Army, Netherlands; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 7 - 1 - 7 - 8; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The effect of supplementation of the amino acid L-tyrosine on cognitive task performance was assessed during a highly demanding two-week combat training course. A tyrosine group (10 subjects) received daily doses of a protein-rich drink (containing 2 g tyrosine), while a placebo group (11 subjects) received the same doses of a carbohydrate rich drink (containing no proteins). Cognitive task performance was evaluated immediately preceding the course, as well as at the end of the first week of the course. Although there were no group differences in task performance prior to the course, the tyrosine group clearly performed better than the placebo group on several cognitive performance tasks during the course. Overall, up to 40% of the cognitive performance decrement that was due to the impact of stress and fatigue, was counteracted by the supplementation of tyrosine. The findings suggest that tyrosine supplementation can be effective in preventing cognitive degradation in highly demanding military operational environments that include sustained operations, as well as physical and psychological stressors.

Author

Tyrosine; Military Operations; Human Performance; Amino Acids; Cognition

20000033311 Aeromedical Inst., Soesterberg, Netherlands

Sleep and Alertness Management During Military Operations: Questions to be Answered

Simons, M., Aeromedical Inst., Netherlands; Valk, P. J. L., Aeromedical Inst., Netherlands; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 8 - 1 - 8 - 8; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

Sleep and alertness management is a major point of attention for the medical support of military round the clock operations. Crew's awareness on the effects of fatigue and sleepiness should be enhanced. Flight surgeons should be trained on the use of practical methods to prevent serious fatigue and to enhance performance and alertness of the crew. Although, in civil and in military aviation a considerable number of studies have been conducted on fatigue countermeasures and preventive strategies, results are not readily available for practical use by flight surgeons. In order to develop useful guidelines for flight surgeons and crew, the international aeromedical research community should be able to produce a database on what is already known and identify areas where knowledge is lacking. In this context research questions related to the use of strategic naps, hypnotics, stimulants, and chronobiotic treatment are put forward.

Author

Sleep; Alertness; Military Operations; Fatigue (Biology)

20000033313 Portuguese Air Force Aeromedical Center, Training and Flight Safety Dept., Lisbon, Portugal

Portuguese Air Force Aeromedical Centre Approach to Management of Sleep/Wakefulness of Aircrew

Ribeiro, Nuno Pedro, Portuguese Air Force Aeromedical Center, Portugal; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 10 - 1 - 10 - 3; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

The first time we noticed that we had a problem with the lack of guidelines to manage the sleep/wakefulness disturbances among aircrew was during the time we had a P3-P stationed in Sigonella (IT) flying integrated in a NATO force. They were there during periods of 15 days flying following a schedule that we can see an example in Figure 1. According to this we sent there a flight surgeon that detected two major problems: the lack of regularity on shiftwork and overworkload. We have to add to the hours we can see in the example, 3) more hours of pre-flight briefing and two hours of debriefing, all with only one crew. An additional problem was the location of the rooms of the NCOs, either air crewmembers or ground crew-members, situated near the flight line, submitted to high levels of noise and very difficult to get dark enough during the day, limiting a good or sufficient period of sleep. All the personnel had difficulty to get alcoholic beverages or exercise near exhaustion.

Author

Aerospace Medicine; Flight Crews; Wakefulness; Sleep

20000033314 Aeronautica Militare Italiana, Reparto Medicina Aerospaziale, Rome, Italy

Sleep Tendency and Ability to Sustain Wakefulness

Porcu, Silvio, Aeronautica Militare Italiana, Italy; Casagrande, Maria, Aeronautica Militare Italiana, Italy; Ferrara, Michele, Aeronautica Militare Italiana, Italy; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 11 - 1 - 11 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

During sustained military operations it is often necessary to cope with prolonged periods of wakefulness and irregular rest-activity patterns. In these situations a severe sleep debt can accumulate, leading to increasing levels of sleepiness on the job and, consequently, to dangerous decreases of performance. A number of possible pharmacological and nonpharmacological countermeasures have been studied. Prophylactic naps (short periods of sleep before long periods of work) are probably the best non-pharmacological tool to reduce fatigue and improve performance (e.g., Bonnet, 1991). They have to take place according to some "chronobiological rules": for example, it is well known that sleep propensity shows a biphasic distribution, with an early morning (5.30-7.30 hours) and a mid afternoon (15.30) peak, defined "primary and secondary sleep gates" by Lavie (1986). In addition, naps should be scheduled before the accumulation of a severe sleep debt and placed far from the circadian trough of body temperature rhythm in order to minimize sleep inertia effects (e.g., Dinges, Orne Orne, 1985).

Author

Sleep; Wakefulness; Military Operations; Circadian Rhythms

20000033315 Polish Air Force Inst. of Aviation Medicine, Inst. of Psychiatry and Neurology, Warsaw, Poland

Usefulness of Sleep Records After Mild Head Trauma to Predict Shift Work Effectiveness

Maksymiuk, Grzegorz, Polish Air Force Inst. of Aviation Medicine, Poland; Jernajczyk, Wojciech, Polish Air Force Inst. of Aviation Medicine, Poland; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs

in Sleep-Wakefulness Management; March 2000, pp. 12 - 1 - 12 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

Validity of polysomnography for determining the post-traumatic sequelae was evaluated in 33 male patients after a mild head trauma. The results indicate that shortly after the trauma accompanied by the brain commotion disturbances in sleep architecture can be detected by means of polysomnography. We also demonstrate that polysomnography is a sensitive method of evaluation of early post-traumatic alterations within the CNS. Based on the results of the present study we conclude that the described diagnostic procedure should become a steady element of the clinical evaluation and qualification of patients presenting with subjective symptoms as the sequelae of a mild head trauma.

Author

Sleep Deprivation; Signs and Symptoms; Central Nervous System; Records

20000033316 Interior Dept., Center of Neurology and Medical Psychology, Genoa, Italy

Sleepiness in a Population of Italian Shift-work Policemen

Garbarino, S., Interior Dept., Italy; Nobili, L., Genoa Univ., Italy; Balestra, V., Genoa Univ., Italy; Beelke, M., Genoa Univ., Italy; DeCarli, F., National Council of Research, Italy; Cordelli, A., Interior Dept., Italy; Ferrillo, F., Genoa Univ., Italy; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 13 - 1 - 13 - 4; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Various studies have shown that sleep disorders and daytime sleepiness are the more frequent disturbances reported by shift-workers (1,2). Shift-work interferes with both the quality and quantity of sleep. Concerning the duration of sleep, there is a decrease in the number of hours of sleep both during morning shifts, due to early awakening, and during night shifts due to the inversion of the normal sleep-wake cycle (3). The increase in body temperature, observed starting from the early morning hours, and the unfavorable environmental conditions (noise, family and social life, etc.) make it more difficult to fall asleep during the day (4,5). Data reported in the literature show how sleepiness and fatigue can increase the risk of human errors and accidents (6,7). Night work and loss of sleep may account for some recent serious accidents (Three-Mile Island 1979, Chernobyl 1986, Exxon Valdez 1989).

Author

Sleep; Populations; Errors; Sleep Deprivation; Personnel

20000033317 Italian Air Force Pratica di Mare, Aerospace Medicine Dept., Rome, Italy

Sleep Inertia and On-Call Readiness

Ferrara, Michele, Italian Air Force Pratica di Mare, Italy; Casagrande, Maria, Italian Air Force Pratica di Mare, Italy; Porcu, Silvio, Italian Air Force Pratica di Mare, Italy; DeGennaro, Luigi, Rome Univ., Italy; Bertini, Mario, Rome Univ., Italy; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 14 - 1 - 14 - 7; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The effects of sleep deprivation and chronobiological variations in performance are undoubtedly among the most pervasive limiters of human ability in all situations that require sustained periods of continuous performance and in around-the-clock work settings (e.g. Dinges et al., 1988). These work scenarios are becoming increasingly common, often involving highly skilled and dedicated personnel as in sustained military operations, space flight preparation and launching, crisis and catastrophe management (Mitler et al., 1988). In all these situations, the negative effects of sleep loss during sustained operations must be compared to the adverse effects of sleep inertia upon abrupt awakening from sleep due to a possible emergency (Dinges et al., 1988; Dinges, 1990).

Author

Sleep; Inertia; Military Operations; Personnel; Sleep Deprivation

20000033318 Institut de Medicine Aerospatiale Armee, Bretigny sur Orge, France

Influence of Age and Gender on Jet-Lag Syndrome: Recommendations

Lagarde, Didier, Institut de Medicine Aerospatiale Armee, France; Beaumont, Maurice, Institut de Medicine Aerospatiale Armee, France; Batejat, Denise, Institut de Medicine Aerospatiale Armee, France; Catrycke, Marc, Institut de Medicine Aerospatiale Armee, France; VanBeers, Pascal, Institut de Medicine Aerospatiale Armee, France; French, Jonathan, Armstrong Lab., USA; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 15 - 1 - 15 - 3; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Jet-lag syndrome in civilian flight personnel is quite well known. In Air Force crews, especially during longhaul flights, jet-lag is associated with sleep deprivation and a specific environment. In this communication, we present some results of a real world experiment (simulation of troops deployment) after a transmeridian flight in which we evaluated notably the influence of age and gender in this kind of jet-lag. In our population, composed of 27 US Air Force reservists, males and females from 19 to

46 years old, we did not find any important differences due to age and/or gender. Only subjective data, recorded from Sleep Log, presented statistical differences. Nevertheless in the global population the jet-lag induced disturbances in 33% of the studied parameters. Some physiological and/or pharmacological recommendations are done.

Author

Age Factor; Jet Lag; Signs and Symptoms; Sleep Deprivation; Sex Factor

20000033319 Dortmund Univ., Inst. for Occupational Physiology, Germany

The Adaptability of Individuals to Shiftwork: A Possible Experimental Approach

Griefahn, Barbara, Dortmund Univ., Germany; Degen, Gisela, Dortmund Univ., Germany; Blaszkewicz, Meinolf, Dortmund Univ., Germany; Golka, Klaus, Dortmund Univ., Germany; Kuenemund, Christa, Dortmund Univ., Germany; Their, Ricarda, Dortmund Univ., Germany; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 18 - 1 - 18 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The Institute for Occupational Physiology at the University of Dortmund has been an important research center for shiftwork. This line of research was terminated a decade ago, when Joseph Rutenfranz died in 1989 and Peter Knauth became Professor at the University of Karlsruhe. Now, this topic will be resumed by a scientist with an extended experience in sleep research focused on experimental studies and field observations on sleep disturbances as caused by environmental noise [10, 11]. Research on shift-work now will be executed in close cooperation with the biochemical unit of the institute.

Author

Adaptation; Personnel; Biochemistry

20000033320 Army Aeromedical Research Lab., Fort Rucker, AL USA

Napping Strategies to Counteract Sleep Deprivation

Caldwell, J. Lynn, Army Aeromedical Research Lab., USA; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 19 - 1 - 19 - 11; In English; See also 20000033303; Copyright Waived; Avail: CASI; A03, Hardcopy

There is an abundance of evidence indicating that a nap taken during long periods of otherwise continuous wakefulness is extremely beneficial for improving alertness and performance. However, scheduling naps is not a simple matter. Several factors are important to consider before implementing a napping regime into a continuous operations scenario.

Author

Alertness; Sleep Deprivation; Wakefulness

20000033321 Norwegian Defence Research Establishment, Kjeller, Norway

Polyphasic Sleep and Napping Strategies

Opstad, Per Kristian, Norwegian Defence Research Establishment, Norway; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 20 - 1 - 20 - 2; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Sleep deprivation is the most detrimental stress factor for mental performance during continuous military operations. First of all it affects all subjective parameters such as well-being, mood state, motivation, creativity, care for others or social surplus. These changes are followed by alterations in psychometric performance tests such as vigilance tasks, with increasing number of omissions, complex tasks, cognitive functions, reduced reaction speed and learning capacity. When sleep is totally denied for several days more serious neurological symptoms appear such as slow motion, balance disturbance, nystagmus, headache, visual hallucination and sleep narcosis. All this symptoms are most apparent during night-time.

Author

Sleep Deprivation; Human Performance; Mental Performance; Military Operations; Alertness; Stress (Biology)

20000033322 Aeronautica Militare Italiana, Reparto Medicina Aeroapaziale, Rome, Italy

Assessing the Adaptability to Irregular Rest-Work Rhythms in Military Personnel

Porcu, Silvio, Aeronautica Militare Italiana, Italy; Casagrande, Maria, Aeronautica Militare Italiana, Italy; Ferrara, Michele, Aeronautica Militare Italiana, Italy; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 21 - 1 - 21 - 5; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Operational decreases in performance resulting from sleep deprivation or irregular sleep-wake patterns are well known and are becoming increasingly important in today's industrialized society. Excessive sleepiness at unusual hours is estimated to affect

approximately 5% of the general population and is associated with increased morbidity, loss of work hours, reduced productivity, increased work errors and impaired social and family relationship. In addition, there is an increased mortality risk when sleepiness affects motor vehicle and train drivers, aircraft pilots, nuclear power workers, and, generally, people involved in crucial occupations (e.g. Mittler, Carskadon, Czeisler, Demerit, Dinges, Curtis, Graeber, 1988).

Author

Adaptation; Personnel; Productivity; Estimating; Sleep Deprivation

20000033323 Kaunas Medical Univ., Inst. of Psychophysiology and Rehabilitation, Kaunas, Lithuania

Analysis of Heart Rate Variability During Sleep as a Tool for Assessment of Cardiovascular Adaptability and Fatigue in Sleep-Wake Cycle

Varoneckas, G., Kaunas Medical Univ., Lithuania; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/ Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 22 - 1 - 22 - 7; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

An assessment of general adaptation reserve of cardiovascular function by means of heart rate (HR) and HR variability analysis during sleep and functional tests is demonstrated. A possibility to evaluate a restoration of cardiovascular reserve after sleep by means of HR changes during active orthostatic test is shown. The level of autonomic HR control and balance of sympathetic-parasympathetic inputs might be measured by means of analysis of HR power spectrum main oscillatory components. The differences in cardiovascular reserve of healthy subjects and cardiac patients, as well as possibility of HR restoration during sleep was demonstrated. In conclusion, adaptability of cardiovascular function and fatigue-restoration cycle might be assessed by means of very simple methodology - an analysis of HR Poincare maps. Its practical application in the cases of fatigue, developed during disturbed wake-sleep cycle or overtraining situation in high physical or emotional overcrowding is shown.

Author

Heart Rate; Sleep; Cardiovascular System; Adaptation; Fatigue (Biology)

54

MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also 16 Space Transportation and 52 Aerospace Medicine..

20000028289 Cornell Univ., Ithaca, NY USA

Extravehicular Activity Suit Systems Design: How to Walk, Talk, and Breathe on Mars

Barton, George, Cornell Univ., USA; Cox, Akio, Cornell Univ., USA; DeFlores, Lauren, Cornell Univ., USA; Garber, Ari, Cornell Univ., USA; Goldsmith, Randall, Cornell Univ., USA; Lee, Brett, Cornell Univ., USA; Mathews, Saemi, Cornell Univ., USA; Diehl, Alison, Cornell Univ., USA; Haenlein, Joel, Cornell Univ., USA; Mitchell, Jonathan, Cornell Univ., USA; Second Annual HEDS-UP Forum; 1999, pp. 55-76; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Design parameters for a Mars Extravehicular Mobility Unit (EMU) are different from current space shuttle and past Apollo EMU designs. This report derives functional requirements for the life support, communication, and power subsystems of a Mars EMU from the HEDS reference mission and Mars surface conditions and proposes a design that satisfies all of the currently understood functional requirements for each subsystem. Design for the life support system incorporates O₂ storage, possible O₂ production, CO₂ absorption, humidity control, thermal regulation, and radiation protection. The communication system design centers on a reconfigurable wireless network, virtual retinal display, and emergency locator beacons. Portable power options are analyzed, and Direct Methanol Liquid Feed Fuel cells are selected for use in a design that satisfies the power requirements. Mass, cost, and technological readiness are considered for each system. This paper concludes with a recommended combination of subsystem designs that combine to form the primary subsystems of a Mars EMU.

Author

Extravehicular Mobility Units; Functional Design Specifications; Life Support Systems; Mars Surface; Mars (Planet); Manned Mars Missions; Mars Exploration

20000028298 Texas Univ., San Antonio, TX USA

MAGIC: Mars Advanced Greenhouse Integrated Complex

Arizzi, Rocco Vincent, Texas Univ., USA; Bennett, Phillip, Texas Univ., USA; Clare, Sharron, Texas Univ., USA; Forbes, Jacob Edward, Texas Univ., USA; Hernandez, Paul, Jr., Texas Univ., USA; Barricklow, Paul, Texas Univ., USA; Coursen, Garth

Edward, Texas Univ., USA; Torres, Charly, Texas Univ., USA; Walsh, Michael James, Texas Univ., USA; Wedel, Dale, Texas Univ., USA; Second Annual HEDS-UP Forum; 1999, pp. 227-246; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Human Exploration and Development of Space (HEDS) is a strategic enterprise of the National Aeronautics and Space Administration (NASA). One of the many goals of this initiative is the exploration and colonization of the planet Mars. One approach to this ambitious undertaking is to transport a minimum of resources and utilize as many Martian resources as possible, reducing the overall cost of the mission. A long duration mission, which utilizes in-situ plant growth-facilities, reduces the dependence on consumable supplies from earth. The reduced number of cargo launches required lowers the cost of the project. Additional equipment may then be shipped in place of consumables. Data obtained from growing food on Mars can be used in planning for permanent habitation of the planet. A team of undergraduate students and professors at the University of Texas at San Antonio (UTSA) has developed the Mars Advanced Greenhouse Integrated Complex (MAGIC).

Author

Greenhouses; Vegetation Growth; Consumables (Spacecrew Supplies); Food Production (In Space)

20000028361 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Advanced Air Bag Technology Assessment Final Report

Phen, R. L., Jet Propulsion Lab., California Inst. of Tech., USA; Dowdy, M. W., Jet Propulsion Lab., California Inst. of Tech., USA; Ebbeler, D. H., Jet Propulsion Lab., California Inst. of Tech., USA; Kim, E.-H., Jet Propulsion Lab., California Inst. of Tech., USA; Moore, N. R., Jet Propulsion Lab., California Inst. of Tech., USA; VanZandt, T. R., Jet Propulsion Lab., California Inst. of Tech., USA; April 1998; 278p; In English

Report No.(s): JPL-Publ-98-3; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

As a result of the concern for the growing number of air-bag-induced injuries and fatalities, the administrators of the National Highway Traffic Safety Administration (NHTSA) and the National Aeronautics and Space Administration (NASA) agreed to a cooperative effort that "leverages NHTSA's expertise in motor vehicle safety restraint systems and biomechanics with NASA's position as one of the leaders in advanced technology development... to enable the state of air bag safety technology to advance at a faster pace..." They signed a memorandum of understanding for NASA to "evaluate air bag performance, establish the technological potential for improved (smart) air bag systems, and identify key expertise and technology within the agency (NASA) that can potentially contribute significantly to the improved effectiveness of air bags." NASA is committed to contributing to NHTSA's effort to "(1) understand and define critical parameters affecting air bag performance, (2) systematically assess air bag technology state of the art and its future potential, and (3) identify new concepts for air bag systems." The Jet Propulsion Laboratory (JPL) was selected by NASA to respond to the memorandum of understanding by conducting an advanced air bag technology assessment.

Derived from text

Air Bag Restraint Devices; Motor Vehicles; Technology Assessment; Biodynamics

20000029553 Institute of Space Medico-Engineering, Beijing, China

Safety Analysis for Astronaut and the Personal Protective Equipment

Chen, Jin-dun, Institute of Space Medico-Engineering, China; Sun, Jin-biao, Institute of Space Medico-Engineering, China; Shi, He-ping, Institute of Space Medico-Engineering, China; Sun, Hai-long, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 418-422; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study was to analyze and study astronauts and their personal safety equipment. Three of the most widely used approaches, failure mode and effect analysis (FMEA), fault tree analysis (FTA) and system hazards analysis (SHA) were used. It was demonstrated that astronauts and their personal equipment are subjected to various potential hazards, such as human errors, astronaut illness, fire or space suit emergency decompression, etc. Their causes, mechanisms, possible effects and criticality of some critical potential hazards were analyzed and identified in more details with considerations of the historic accidents of manned spaceflight. The compensating provisions and preventive measures for each hazard were discussed. The analysis study may be helpful in enhancing the astronaut safety and their personal protective equipment.

Author

Astronauts; Space Suits; Aerospace Safety; Flight Safety; Safety Devices

20000029554 Institute of Aviation Medicine, Beijing, China

Technical Consideration of Setting Up a Specification for Human Centrifuge Evaluation of Anti-G Equipment

Zhan, Chang-lu, Institute of Aviation Medicine, China; Geng, Xi-chen, Institute of Aviation Medicine, China; Zhang, Wu-xing, Institute of Aviation Medicine, China; Yan, Gui-ding, Institute of Aviation Medicine, China; Chu, Xu, Institute of Aviation Medicine, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 441-444; In Chinese; Copyright; Avail: Issuing Activity

Anti-G equipment needs to be evaluated using human centrifuge before further developed. However, there is not a general specification for human centrifuge evaluation of anti-G equipment. From related literature and from our over thirty years experience in this area, we summarize five aspects of technical consideration below: human centrifuge, medical specification for using humans in + Gz stress experiment, anti-G equipment experimental assembly, principles should be applied during human centrifuge evaluation of anti-G equipment. We hope that the technical considerations mentioned in the paper should be helpful to the work of setting up a specification for human centrifuge evaluation anti-G equipment. After we have a specification, the research will be conducted in an orderly manner and the anti-G equipment will be developed.

Author

Antigravity; Human Centrifuges; Specifications; Simulation; Design Analysis; Equipment Specifications

20000029579 Institute of Space Medico-Engineering, Beijing, China

Physiological Basis of Human Mechanics and Its Application in the Design of Pressure Suit

Jia, Si-guang, Institute of Space Medico-Engineering, China; Chen, Jing-shan, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 436-440; In Chinese; Copyright; Avail: Issuing Activity

The objective of this paper is to discuss the necessity that human mechanics and the physiological basis as applied to the research of human motion in many areas. The motion performance of two aerospace pressure suit were studied. Human mechanics and its physiological basis was applied to the design of one suit only. The result showed that good performance was obtained with the suit designed according to this principle which the stipulated actions could not be performed as well when wearing the suit not so designed. The research of the application of human mechanics and its physiological basis is necessary, has better reality, and is more scientific than applying biomechanics and robotics.

Author

Physiology; Pressure Suits; Space Suits; Bioengineering; Human Performance; Human Body

20000029608 Institute of Aviation Medicine, Beijing, China

Integrated Protection Capability Afforded by a New Type Capstan Anti-G Equipment and Anti-G Straining Maneuver

Geng, Xi-chen, Institute of Aviation Medicine, China; Zhan, Chang-lu, Institute of Aviation Medicine, China; Yan, Gui-ding, Institute of Aviation Medicine, China; Chu, Xu, Institute of Aviation Medicine, China; Lu, Xia, Institute of Aviation Medicine, China; Zhang, Wu-xing, Institute of Aviation Medicine, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 406-408; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study was to investigate the integrated protection capability afforded by a new type capstan anti-G equipment and anti-G straining maneuver, as a result we discussed the feasibility of protection for 8 G 10 s (rapid onset runs at 2 G/s) acceleration using an associated precept with both of the above anti-G measures. This study was accomplished using the human centrifuge with rapid onset at 2 G/s. First, we determined the relaxed +Gz tolerance of nine male aviation students. We then determined their highest +Gz tolerance for five aviation students using a new type capstan anti-G suit (NKH) and a new type anti-G valve (NKT) + L-1 anti - G straining maneuver (L-1). The other four aviation students used a new type capstan counterpressure suit (NDC) + the new type anti-G valve (NKT) + L-1. The highest + Gz tolerance of five students was 8.80 +/- 0.27 G while using NKH+ NKT+ L-1. This was higher than their relaxed + Gz tolerance at 4.60 +/- 0.42 G (Pis less than 0.01) ; and that the most + Gz tolerance of four students was 8.75 +/- 0.50 G while using NDC + NKT + L- 1 and was higher than their relaxed + Gz tolerance at 4.50 +/- 0.46 G (p is less than 0.01). TA pilot will be capable against the 8 G 10 s (rapid onset runs at 2 G/s) effectively using the new type capstan anti +/- G equipment and anti +/- G straining maneuver, and the provided precept has availability.

Author

Antigravity; Pressure Suits; High Gravity Environments; Acceleration Tolerance

20000030717 Department of the Navy, Washington, DC USA

Footwear Having a Variable Sized Interior

Hall, Robert W., Inventor; Heath, Cleveland A., Inventor; Mack, Alison B., Inventor; Neiley, Roger T., Inventor; Aug. 17, 1999; 5p; In English

Patent Info.: Filed 22 Aug. 97.; US-Patent-Appl-SN-08,919,072; US-Patent-5,937,543

Report No.(s): AD-D019601; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A variable size footwear includes a sole, an upper fixed to the sole and an insole overlying the sole within the upper. An inner sock of elastic material is fixed to the sole and/or insole. The sock in an unstressed state is smaller than the upper, but is expandable to a size conforming to interior walls of the upper. The sock is fixed at an upper edge thereof to the upper.

DTIC

Patents; Shoes; Socks

20000031749 Beijing Univ., Inst. of Man-Machine-Environment, China

Research Progress of Thermal Control System for Extravehicular Activity Space Suit

Wu, Zhi-qiang, Beijing Univ., China; Yuan, Xiu-gan, Beijing Univ., China; Shen, Li-ping, Beijing Univ., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 303-307; In Chinese; Copyright; Avail: Issuing Activity

New research progress of thermal control system for oversea Extravehicular Activity (EVA)space suit is presented. Characteristics of several thermal control systems are analyzed in detail. Some research tendencies and problems are discussed, which are worthwhile to be specially noted. Finally, author's opinion about thermal control system in the future is put forward.

Author

Temperature Control; Extravehicular Activity; Space Suits

20000031877 Department of the Navy, Washington, DC USA

Accelerated Gas Removal from Divers' Tissues Utilizing Gas Metabolizing Bacteria

Kayar, Susan R., Inventor; Axley, Milton J., Inventor; Jul. 13, 1999; 6p; In English; Supersedes US-Patent-Appl-SN-08852207 Patent Info.: Filed 6 May 1997; US-Patent-Appl-SN-08,852,207; US-Patent-5,922,317

Report No.(s): AD-D019557; No Copyright; Avail: US Patent and Trademark Office, Microfiche

This invention relates to a method for biochemical assistance in the decompression of divers using a breathing mixture of oxygen and a nitrogen or hydrogen gas diluent and a product for accomplishing the decompression. More particularly, this invention relates to a process for assisting in the removal of hydrogen gas (H₂) or nitrogen gas (N₂) from the systems of divers breathing H₂ or N₂ mixtures under hyperbaric conditions and a product for accomplishing decompression assistance. This product and method supplements and accelerates the removal of hydrogen and nitrogen gas that occurs spontaneously during conventional decompression of divers.

DTIC

Diving (Underwater); Underwater Physiology; Pressure Reduction; Underwater Breathing Apparatus; Life Support Systems; Inventions; Patents

20000031893 Michigan Univ., Transportation Research Inst., Ann Arbor, MI USA

Effects of Visual Demand and In-Vehicle Task Complexity on Driving and Task Performance as Assessed by Visual Occlusion, Sep. 1997 - Sep. 1999

Tsimhoni, O.; Yoo, H.; Green, P.; Dec. 1999; 82p; In English

Report No.(s): PB2000-102983; UMTRI-99-37; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

Given the recent proliferation of in-vehicle systems, understanding how drivers deal with the visual demands of driving while operating these systems is essential. To provide such, 16 subjects drove a simulator on roads with long curves of several different radii while providing verbal responses to questions about the content of electronic maps displayed on the center console. In additional sessions, visual demand of the same road segments was measured using the voluntary occlusion technique. Task completion time while driving was correlated with static completion time, generally increasing when the task was performed while driving. It decreased, however, for short tasks, especially when only one glance was made. As driving workload increased, subjects made shorter glances at the display, made more of them, but waited longer between glances. The net effect was a slight decrease in total glance duration (eyes-off-the-road time). As driving workload increased, driving performance became worse.

NTIS

Human Performance; Task Complexity; Human Factors Engineering; Motor Vehicles

20000031925 Tsinghua Univ., Dept. of Engineering Mechanics, Beijing, China

Analysis of Mass Optimization of Manned Spacecraft ECLSS Thermal-Hydraulic Network

Zhang, Xin-Rong, Tsinghua Univ., China; Ren, Jian-Xun, Tsinghua Univ., China; Liang, Xin-Gang, Tsinghua Univ., China; Guo, Zeng-Yuan, Tsinghua Univ., China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 351-355; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to reduce the weight of manned spacecraft Environment Control and Life Support System (ECLSS). Based on network analysis theory, the flow and thermo-hydraulic network composed of gas and liquid loops in manned spacecraft ECLSS was explored to reduce the weight of ECLSS. The physical models and mathematical models of flow, heat transfer and weight calculation in the network were established. The thermodynamic parameters and weight of the network were calculated on the bases of energy balance, heat transfer relation and the component weight relation. and influencing factors on the system weight were discussed. (1) There is an optimal pipe diameter in the system and the diameter is influenced by flow rate to a large extent; (2) The weight can be reduced by raising inlet temperature properly; (3) The best heat exchange layout makes the weight lightest. Conclusion The obtained results are of importance for reducing launching weight of manned spacecraft.

Author

Mass; Optimization; Environmental Control; Life Support Systems; Network Analysis

20000031964 Institute of Space Medico-Engineering, Beijing, China

On Ergonomics of Spacesuit

Jia, Si-Guang, Institute of Space Medico-Engineering, China; Chen, Jing-Shan, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 371-375; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The concept and the connotation of spacesuit ergonomics are specified. The method of ergonomics was applied to spacesuit design and the design demands for comfort, fitting and space compatibility of spacesuit are indicated systematically by applying anthropometry and building spacesuit size system (including weightlessness). Flexibility and posture of spacesuit are indicated with human mechanics (including weightlessness). The present situation of ergonomic research of spacesuit is discussed simply.

Author

Space Suits; Human Factors Engineering; Design Analysis

20000032160 NASA Johnson Space Center, Houston, TX USA

A Human Factors Evaluation of a Methodology for Pressurized Crew Module Acceptability for Zero-Gravity Ingress of Spacecraft

Sanchez, Merri J., NASA Johnson Space Center, USA; March 2000; 146p; In English

Report No.(s): NASA/TM-2000-209764; NAS 1.15:209764; S-854; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This project aimed to develop a methodology for evaluating performance and acceptability characteristics of the pressurized crew module volume suitability for zero-gravity (g) ingress of a spacecraft and to evaluate the operational acceptability of the NASA crew return vehicle (CRV) for zero-g ingress of astronaut crew, volume for crew tasks, and general crew module and seat layout. No standard or methodology has been established for evaluating volume acceptability in human spaceflight vehicles. Volume affects astronauts' ability to ingress and egress the vehicle, and to maneuver in and perform critical operational tasks inside the vehicle. Much research has been conducted on aircraft ingress, egress, and rescue in order to establish military and civil aircraft standards. However, due to the extremely limited number of human-rated spacecraft, this topic has been un-addressed. The NASA CRV was used for this study. The prototype vehicle can return a 7-member crew from the International Space Station in an emergency. The vehicle's internal arrangement must be designed to facilitate rapid zero-g ingress, zero-g maneuverability, ease of one-g egress and rescue, and ease of operational tasks in multiple acceleration environments. A full-scale crew module mockup was built and outfitted with representative adjustable seats, crew equipment, and a volumetrically equivalent hatch. Human factors testing was conducted in three acceleration environments using ground-based facilities and the KC-135 aircraft. Performance and acceptability measurements were collected. Data analysis was conducted using analysis of variance and nonparametric techniques.

Author

Acceptability; Technology Assessment; Procedures; Human Factors Engineering; Gravitation

20000032198 Tuskegee Inst., Center for Food and Environmental Systems for Human Exploration of Space, AL USA
The Development of an Edible Peanut Protein Film

Patrick, N., Tuskegee Inst., USA; Jones, G., Tuskegee Inst., USA; Aglan, H., Tuskegee Inst., USA; Lu, J., Tuskegee Inst., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 489-494; In English; See also 20000032189 Contract(s)/Grant(s): NCC9-51; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche; C01, CD-ROM

The peanut is one of the crops chosen for use in NASA's Advanced Life Support Program (ALS). The peanut is a source of both oil and protein. After oil is extracted from the peanut, a protein rich flour remains. An edible peanut protein film is one use for this flour. Two types of film are developed for this study, one set of film contains 10% fat while the other set contains no fat. For film without fat the defatting of the peanut by the Soxhlet method is the first step in the manufacturing process of the film. Secondly, the protein is precipitated at its isoelectric point (pH 4.5) and centrifuged to separate the protein from the non-protein. After freeze-drying the protein it is milled in a ceramic ball mill to decrease particle size and sifted through a series of sieves to determine particle size distribution. Those particles retained on the 100 mesh sieves are utilized for film formation. Larger particles are re-ground and sifted. Five grams of protein is mixed with 50 mL of distilled water, 70 mL of 80% ethanol, 15 mL of 6N ammonium hydroxide and a plasticizer. This mixture is heated for 30 minutes until the temperature reaches 70 C. The mixture is then poured onto a level Teflon coated glass surface. After allowing the film to form overnight under a ventilation hood, it is manually removed from the plate. The processes and methods adopted have created flexible films of uniform thickness that are free of air bubbles. Thickness of films made from defatted peanut protein and partially defatted peanut protein were 0.10 Lm and 0.13 Lm respectively. Films with natural peanut fat are approximately three times as flexible and almost four times as strong as the films made without fat. Further research will be performed to evaluate its mechanical properties. This paper will greatly contribute to food preservation and waste management. Potential applications of this film are edible/biodegradable containers, wrapping for food preservation (against water, oxygen and oil), storage packets for seasonings or other ingredients and encapsulation for pharmaceutical use.

Author

Biodegradability; Farm Crops; Freeze Drying; Mechanical Properties; Oils; Preserving; Proteins

20000032264 NASA Marshall Space Flight Center, Huntsville,AL USA

Comparison of Human Modelling Tools For Efficiency of Prediction of EVA Tasks

Dischinger, H. Charles, Jr., NASA Marshall Space Flight Center, USA; Loughead, Tomas E., NASA Marshall Space Flight Center, USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 160-164; In English; See also 20000032189

Report No.(s): 98URC030; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

Construction of the International Space Station (ISS) will require extensive extravehicular activity (EVA, spacewalks), and estimates of the actual time needed continue to rise. As recently as September, 1996, the amount of time to be spent in EVA was believed to be about 400 hours, excluding spacewalks on the Russian segment. This estimate has recently risen to over 1100 hours, and it could go higher before assembly begins in the summer of 1998. These activities are extremely expensive and hazardous, so any design tools which help assure mission success and improve the efficiency of the astronaut in task completion can pay off in reduced design and EVA costs and increased astronaut safety. The tasks which astronauts can accomplish in EVA are limited by spacesuit mobility. They are therefore relatively simple, from an ergonomic standpoint, requiring gross movements rather than time motor skills. The actual tasks include driving bolts, mating and demating electric and fluid connectors, and actuating levers; the important characteristics to be considered in design improvement include the ability of the astronaut to see and reach the item to be manipulated and the clearance required to accomplish the manipulation. This makes the tasks amenable to simulation in a Computer-Assisted Design (CAD) environment. For EVA, the spacesuited astronaut must have his or her feet attached on a work platform called a foot restraint to obtain a purchase against which work forces may be actuated. An important component of the design is therefore the proper placement of foot restraints.

Derived from text

Extravehicular Activity; Computerized Simulation; Human Factors Engineering; Astronauts; Computer Aided Design; Performance Prediction

20000032301 New Mexico Univ., NASA Center for Autonomous Control Engineering, Albuquerque, NM USA
Integration of Artificial Intelligence, Muscles, and Neural Systems to Replicate Anthropomorphic Systems with Space Applications

Johnson, Mark A., New Mexico Univ., USA; NASA University Research Centers Technical Advances in Aeronautics, Space Sciences and Technology, Earth Systems Sciences, Global Hydrology, and Education; Feb. 22, 1998; Volumes 2 and 3, pp. 819-823; In English; See also 20000032189

Report No.(s): 98URC146; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche; C01, CD-ROM

An overview of the tasks required to integrate artificial intelligence (AI) and synthetic components which mimic anthropomorphic mechanisms is presented. A description is given of the various AI tools (Artificial Neural Networks (ANNs), Fuzzy logic (FL), Genetic Algorithms (GA), . . . which are needed and how they are applied to the problem of controlling both the individual components and a complete anthropomorphic system. The methods used to put together individual components of the anthropomorphic system along with their characterization and integration are developed. Finally, the baseline parameters with which the completed system is to be tested and evaluated are discussed along with identification of potential space applications.

Author

Artificial Intelligence; Muscles; Systems Integration; Neural Nets; Technology Utilization; Aerospace Medicine; Human Body

20000032390 Naval Air Warfare Center, Crew Systems Research and Engineering Dept., Patuxent River, MD USA
Comparison of Vertebral Strength Properties of Anthropometrically Similar Male and Female Using Quantitative Computed Tomography

DiCuccio, M., Thomas Jefferson Univ., USA; Paskoff, G., Naval Air Warfare Center, USA; Whitley, P., M Technologies, Inc., USA; Schweitzer, M., Thomas Jefferson Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 2-1 - 2-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In determining the risk of injury in the military aviation environment, a male and female of the similar height and weight have been assumed to have the same risk of vertebral injury during an escape or crash scenario. A Quantitative Computed Tomography (QCT) study has been performed to analytically quantify the vertebral strength properties between men and women. The study's goals were to examine the vertebral geometry, bone density, end-plate cortical bone thickness, and trabecular bone architectures of the C2, C5, T12 and L4 vertebrae for a subjects pool that consisted of 25 males and 25 females. Additionally, the development of a multivariate regression equation, which would predict the risk of vertebral injury for all individuals and would serve as a guide for designing escape and crash protection systems, was initiated. Preliminary analysis revealed that C2 and C5 trabecular bone mineral densities (BMD mg K₂HPO₄/cc) were significantly higher than those for T12 and L4. When separated by gender the same site relationship held. Female C2 and C5 trabecular bone mineral densities were significantly higher than those for males. Preliminary analysis of gender comparison of endplate cross-sectional area, area density (cross-sectional area x BMD) and predicted strength for the L4 vertebrae revealed that only endplate cross-sectional area was significantly different.

Author

Females; Males; Vertebrae; Crashes; Human Tolerances; Injuries; Tomography; Quantitative Analysis; Anthropometry

20000032391 North Dakota State Univ., Impact Biomechanics Lab., Fargo, ND USA
Modes of Human Head/Neck Response to Vertical Impact

Ziejewski, Mariusz, North Dakota State Univ., USA; Obergefell, Louise, Air Force Research Lab., USA; Perry, Chris, Air Force Research Lab., USA; Anderson, Beth, Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 3-1 - 3-10; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Helmet-mounted systems can change the helmet's mass inertial properties such as weight, moment of inertia, and center of gravity location, this change may alter the head/neck response and possibly change the pattern of neck loading during the catapult phase of ejection (i.e. vertical impact phase). To define the specifications or criteria for allowable head mounted mass and center of gravity location that is safe for the crew members, identification of the head/neck responses and the factors influencing those responses is necessary. The objectives of this study were to identify the modes of head/neck response to vertical impacts, to determine and assess the parameters influencing head/neck response, and to determine a method of predicting mode of head/neck response for a given subject under given conditions. The data used in this study came from five test cells of the Female Impact Program (FIP) study performed at the Air Force Research Laboratory (AFRL) on their Vertical Deceleration Tower (VDT) facility at Wright Patterson Air Force Base, Dayton, Ohio. The subjects were exposed to acceleration levels comparable to those experienced in the catapult phase of ACES II ejections. The peak acceleration level for the tests used in this study was 10 G. Each of the subjects wore the same type of helmet. However, the inertial properties of the helmet were varied to simulate those of current

helmet-mounted systems. Five modes of head/neck response for vertical impact were identified and characterized. Modes A and B represent forward neck and head rotation. Modes C and D represent forward neck rotation and rearward head rotation. Mode E of head/neck response represent no significant neck or head rotation. Two experimental parameters, namely, linear x-acceleration of the head at the mouthpiece and head pitch as measured by the motion of the mouthpiece LED with respect to the shoulder LED, were found to be sufficient to uniquely define the mode of head/neck response. Three categories of parameters have been identified and suggested to be the determining factors in a given subject's mode of response for a given condition. The categories include initial position, anthropometry, and other factors such as helmet, weight, helmet center of gravity location and impact acceleration level.

Author

Anthropometry; Impact Acceleration; Physiological Responses; Helmets; Head (Anatomy); Neck (Anatomy); Injuries; Gravitational Effects; Crews

20000032392 Biodynamic Research Corp., San Antonio, TX USA

A PC-Based Head-Spine Model

Bomar, John B., Jr., Biodynamic Research Corp., USA; Pancratz, David J., Biodynamic Research Corp., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 4-1 - 4-11; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Biodynamic Research Corporation (BRC) of San Antonio, TX, completed a government-sponsored project to port the Air Force's Head-Spine Model (HSM) to a personal computer environment, improve certain features of the software, and add a user-friendly interface. The impetus for this project was the desire to have a software tool capable of modeling the internal forces and motions of the human head and spine during impulsive acceleration events, such as aircraft ejections. The HSM was originally developed in the 1970's over a period of several years. BRC re-coded the model using modern programming techniques and renamed the software HSM-PC. The HSM-PC is a collection of rigid inertial elements and massless deformable elements that represent the anatomy of the human spine. There are multiple versions of the model, with increasing levels of complexity. The HSM-PC simulation program consists of a graphical user interface, a computational module, and a database. The geometry and biomechanical data for the model are stored in Microsoft Access format, and can be viewed from the HSM-PC software or from Access directly. The user interface permits an operator to select different HSM models for a simulation; permits editing of the environment, or simulation parameters; and then allows the user to visually review the results of a simulation through an animation or graphs of desired data. The software stores element, environment, simulation, and other data in separate text files, so that additional simulations with a different environment, different forcing functions, or different body elements can be quickly accomplished. The software runs on Microsoft Windows 95, 98, or NT, and requires a Pentium CPU or equivalent for reasonable operation. It is BRC's belief that there are still sections of the HSM-PC that must be improved to create a validated biomechanical tool with commercial potential. For example, old input files for the original HSM software were noted to have different element properties than published technical reports and journal articles. In many cases, the differences were several orders of magnitude. In addition, the original HSM software did not provide for a way to pre-load the elements of the model. BRC has introduced the concept of "settling" into the HSM-PC, so that the elements of the model have realistic forces and moments acting on them at the start of the simulation. Finally, the element models can be improved significantly. In particular, the muscle and intervertebral disc model can be improved to be more realistic.

Author

Computerized Simulation; Personal Computers; Head (Anatomy); Biological Models (Mathematics); Biodynamics; Impact Acceleration; Spine; Environment Simulation

20000032393 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Crash-Safety Research Centre, Delft, Netherlands

Neck Performance of Human Substitutes in Frontal Impact Direction

Wismans, J. S. H. M., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; vandenKroonenberg, A. J., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Hoofman, M. L. C., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; vanderHorst, M. J., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 5-1 - 5-6; In English; See also 20000032388; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the past several laboratories have conducted human subject tests in order to derive biofidelity performance requirements for crash dummies and computer models. Both human volunteer and human cadaver tests have been conducted. Particularly noteworthy are the human volunteer tests conducted at the Naval Biodynamics Laboratory (NBDL) in New Orleans. In an extensive

test program a large number of human subjects were exposed to impacts in frontal, lateral, and oblique directions. Detailed analyses of these tests have been conducted and presented in various publications. Based on these results, a set of biofidelity performance requirements was developed. These requirements include trajectories and rotations of the head as well as acceleration requirements and data on the neck loads. The objective of this paper is to compare the performance of various human neck models with the observed response in the volunteer tests. Concerning mechanical models, the neck of the Hybrid III dummy, which is the dummy currently specified in motor vehicle safety regulations, as well as the neck of the new THOR dummy will be evaluated. It will be shown that the neck of the THOR dummy offers more biofidelity than the Hybrid III dummy neck. Regarding mathematical neck models, a neck model developed in the MADYMO crash simulation program will be evaluated. It will be shown that the mathematical model which includes a representation of vertebrae, ligaments, and active muscle response is able to reproduce the observed human subject response more accurately than the available mechanical models.

Author

Biodynamics; Computerized Simulation; Neck (Anatomy); Impact Tests; Dummies; Mathematical Models; Human Beings; Impact Loads; Modal Response

20000032394 Simula Technologies, Inc., Phoenix, AZ USA

Validation of the MADYMO Hybrid II and Hybrid III 50th-Percentile Models in Vertical Impacts

Manning, J. E., Simula Technologies, Inc., USA; Happee, R., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 6-1 - 6-30; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes the results of a project conducted by Simula Technologies, Inc., and TNO to validate TNO computer models of 50th-percentile Hybrid II and Hybrid III test dummies when used in a vertical crash condition. Drop tests were conducted at Simula utilizing military impact conditions for helicopter seat certification. After the tests were conducted, computer models of the simulation were made using the MADYMO 3D Crash Victim Simulation program and the test results were compared. The model showed good correlation to the tests in the parameters of interest.

Author

Computerized Simulation; Dummies; Seats; Drop Tests; Crashes; Biological Models (Mathematics); Computer Programs; Dynamic Tests

20000032395 Air Force Research Lab., HEPA, Wright-Patterson AFB, OH USA

Strength of the Female Upper Extremity

Pellettiere, J. A., Air Force Research Lab., USA; Duma, S. M., Virginia Univ., USA; Bass, C. R., Virginia Univ., USA; Crandall, J. R., Virginia Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 7-1 - 7-12; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A dynamic injury tolerance for the female upper extremity was derived from dynamic drop tests onto female cadaveric limbs. Twelve female humeri were tested at a strain rate of 3.7 +/- 1.3 strain/second. The ultimate failure moment (mass scaled to a 5% female) was measured to be 128 +/- 19 Nm. Ten female forearms were tested at a strain rate of 3.94 2.0 strain/second. The ultimate failure moment (mass scaled to a 50% female) was measured to be 58 +/- 12 Nm. A finite element model of the female forearm was constructed from computed tomography data. These data were the basis for the construction of the geometry of the female radius and ulna. A material model previously developed for modeling the mechanical behavior of bone under a variety of loading conditions was applied. Bending simulations of the radius and ulna, both quasi-static and dynamic, were computed, with the results comparing favorably with values available from the literature. Both the model and the testing show that the female forearm is stronger in a supinated (palm up) position than the pronated (palm down) position. The computer modeling demonstrates that with this material model, it is possible to create finite element models of human long bones for the purpose of using them in computational codes for predicting their strength.

Author

Females; Computerized Simulation; Strain Rate; Mathematical Models; Injuries; Dynamic Tests; Bones; Human Tolerances; Finite Element Method

20000032396 Air Force Research Lab., HESA, Wright-Patterson AFB, OH USA

Military Application of Biodynamics Models

Obergfell, Louise, Air Force Research Lab., USA; Rizer, Annette, Veridian, USA; Ma, Deren, Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 8-1 - 8-4; In English; See also 20000032388; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The Air Force Research Laboratory makes extensive use of biodynamics models to evaluate crew system designs and modifications, develop safe design criteria, and predict crewmember response. When special equipment is added to a cockpit for a test program, the Articulated Total Body (ATB) model is used to predict the crewmembers motion during an ejection. by simulating a large crewmember ejecting with his hands both on the firing control panel and on the side seat panel, the risk of significant arm contact is predicted. When the Army is concerned about detonating an item carried by a soldier during a fall from a truck or a parachute landing, the ATB model is used to predict the contact forces on the soldier if they land on a hard surface. When initial ejection seat tests with a new manikin have unusual results, biodynamics modeling is used to help sort out whether the response is due to the seat design or the manikin. Simulations of the tests with possible seat and manikin modifications are used to determine which modifications are most likely to improve results and to narrow future testing requirements. When ejection tests result in extreme manikin leg flail, ATB simulations are used to determine the loads in the hips, which are not measured by the manikin. The process used within AFRL to apply biodynamics modeling to these applications is described and the results presented.

Author

Biodynamics; Biological Models (Mathematics); Computerized Simulation; Crews; Escape Systems; Safety Factors; Design Analysis; Crashes; Dynamic Models; Human Factors Engineering

20000032397 Veridian, Systems Analysis and Research, Dayton, OH USA

Continued Development of an Integrated EASY5/ACESII-ATB Model for Ejection Seat Simulation

Ma, Deren, Veridian, USA; Obergefell, Louise A., Air Force Research Lab., USA; Rogers, Lawrence C., Aeronautical Systems Div., USA; Rizer, Annette L., Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 9-1 - 9-9; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper presents continued development and validation of an integrated ejection/crewmember model, specifically the modeling of aerodynamic effects and the crewmember/seat separation process. In a previous study, an ejection seat model, EASY5/ACESII (Engineering Analysis SYstem/Advanced Concept Ejection Seat), was coupled with a crewmember model, the ATB (Articulated Total Body) model. In this study, newly developed algorithms were incorporated into the integrated model to simulate the aerodynamics and seat/crewmember separation. Wind tunnel data from the ejection seat module are used to obtain total aerodynamic forces on the seat/crewmember combination. The crewmember module then uses an analytical method, based on air pressure and the exposed surface area, to calculate the aerodynamic forces and torques applied to the crewmember's individual body segments. These body forces and torques are then subtracted from the total forces and torques to obtain the force components applied directly to the seat in the ejection seat module. Once the man/seat separation signal is initiated, the aerodynamic forces and torques are applied only to the crew member. Dynamic interaction between the seat and crewmember during the very short period of their separation is complex and critically important. In this study, the harness release and crewmember/seat separation process algorithms were designed and implemented. When the release signal of the harness restraint is generated in the ejection seat module, it is transferred to the crewmember module. The harness belt in the crewmember module is then cut off. Meanwhile, the recovery parachute force from the ejection seat module is sent to the crewmember module. The combined forces due to gravity, recovery parachute, and aerodynamics separate the ejection seat and crewmember. Simulations of F-16/ACESII sled tests were carried out to validate the newly developed features in the integrated model. Simulation results are reported and compared with results of ejection seat sled tests. The validation shows that the model successfully predicts the major features of the ejection seat motion and the crewmember biodynamic responses.

Author

Aerodynamic Forces; Ejection Seats; Escape Systems; Crews; Torque; Computerized Simulation; Mathematical Models; Physiological Responses; Biodynamics

20000032398 JAYCOR, San Diego, CA USA

Head Protection Against Windblast for Crew Escape

Chan, Philemon C., JAYCOR, USA; Yu, James H.-Y., JAYCOR, USA; Stuhmiller, James H., JAYCOR, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 10-1 - 10-15; In English; See also 20000032388 Contract(s)/Grant(s): F41624-95-C-6014; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A pilot ejecting from an aircraft at high speed faces the possibility of windblast head/neck injury. to establish a phenomenological understanding of windblast protection for the head, three stagnation concepts, the unvented fence, the hood and the brim have been evaluated. As tested in the wind tunnel, the unvented fence and hood produce overstagnation which may subject the head to unwanted oscillations. The vented hood and the brim can reduce the normal head force without overstagnation, but with a significant increase of side head force. The side head force increase is caused by windward headrest flow stagnation, as confirmed by

computational fluid dynamics simulations and subscale water tunnel model testing. Studies were performed to reduce the head rest flow stagnation using the open brim concept.

Author

Head (Anatomy); Blasts; Ejection Injuries; Escape Systems; Safety Devices; Neck (Anatomy); Protection; Water Tunnel Tests; Scale Models

20000032399 George Washington Univ., National Crash Analysis Center, Ashburn, VA USA

The Use of Computer Finite Element Models of Humans and Crash Test Dummies for High Acceleration and Impact Biomechanics Studies

Digges, Kennerly H., George Washington Univ., USA; Bedewi, Paul G., George Washington Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 11-1 - 11-14; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The application of computer finite element models provides a valuable method for the study of human injury. The ability to model the complete human body is currently impractical. However, it is possible to model elements of the human body. These elements may be used independently, or in conjunction with models of crash dummies. In the latter case, specific crash dummy elements are replaced with human elements. The resulting model increases the accuracy of the model in predicting human response in high acceleration impacts. The procedure for applying human elements to crash test dummy models is illustrated by substituting human lower limbs on a finite element model of the Hybrid III dummy. The model is validated by replicating tests of human cadaver lower limbs. The model is then applied to predict the effect of muscle activation.

Author

Biodynamics; Finite Element Method; Human Body; Mathematical Models; Crashes; Dummies; Impact Acceleration

20000032401 Technische Univ., Eindhoven, Netherlands

MADYMO Validation of Side Facing Sofa Sled Tests

Teulings, A. M. G. L., Technische Univ., Netherlands; Gowdy, V., Civil Aeromedical Inst., USA; Wismans, J. S. H. M., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Aljundi, B., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek-MADYMO North America, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 13-1 - 13-9; In English; See also 20000032388; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In order to investigate and ultimately improve the crash worthiness of side facing sofas a series of sled tests were performed. The EUROSID-1 dummy was used to measure various signals needed to assess injury potential. To facilitate a parametric study into injury potential related factors a MADYMO computer model of these tests was made and needed to be validated. The correlation between test and simulation signals warrants sufficient trust in the model for it to be used as a baseline model in a parametric study.

Author

Computerized Simulation; Crashworthiness; Injuries; Crashes; Seats; Impact Tests; Dummies; Safety Management

20000032406 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada

Hierarchical Modeling of the Baroreceptor Response to Gz Acceleration and Anti-Gz Protective Equipment

Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 19-1 - 19-5; In English; See also 20000032388; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The use of extended coverage anti-G suits and positive pressure breathing have enhanced the protection of aircrew exposed to high Gz and extreme altitudes. However, current systems do not provide optimal protection to the individual pilot during complex negative-to-positive Gz maneuvers nor do such systems adapt to changes in the physiological state of the pilot over the course of the mission, in part due to the hardware's inability to adapt to the complex response of the blood pressure regulating systems within the body. Current, medically relevant models of baroreceptor function are not suitable for the extreme changes in blood pressure and blood distribution in a body exposed to very high Gz levels of the tactical environment. Using a mix of first principle and data driven techniques, we are developing hierarchical models of baroreceptor function that include the interaction between the neuronal sub-components of the baroregulation centers of the central nervous system, the transient dynamics of pressure induced stretch in the baroreceptor organs, the effects of local pressure gradients within the aortic/carotid baroreceptor system, and the dynamic response of each of the subsystems during Gz exposures. All of these factors play a significant role in

the individual's response to the Gz forces and the efficacy of the life support systems in preventing an adverse impact on cerebral blood flow and oxygenation of the brain.

Author

Baroreceptors; Acceleration Stresses (Physiology); Acceleration Protection; Pressure Breathing; Neurophysiology; Flight Crews; Acceleration Tolerance; Gravitational Effects; Pressure Suits

20000032407 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada

Modeling of the Physiological Responses to Non-Linear G-Suit and Positive Pressure Breathing Schedules

Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Lu, Z., Engineering Services, Inc., Canada; Askari, V., Engineering Services, Inc., Canada; Kapps, A., Engineering Services, Inc., Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 20-1 - 20-8; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Heart level blood pressure responses to G-suit pressures (2-8 psi) with and without Positive Pressure Breathing (5-60 mm Hg) at +1Gz were investigated in this paper for six test subjects. Various models were developed and tested to simulate these responses. The results show that a single-zero, two-pole, output-error model is suitable for characterizing the blood pressure responses to G-suit and Positive Pressure Breathing (PPB) pressures. A single-input model is used for the case of G-suit pressure with and without synchronized PPB, whereas a double-input model is used for the case of G-suit pressure with asynchronous PPB. The suitability of the models developed to high +Gz environment is investigated based on the data from a prior centrifuge test of one subject. Special dynamic indices are used to quantify the characteristics of the blood pressure responses. Significant variations in the dynamic indices of individual subjects and the same subject observed at different time instances are seen. These variations indicate that a fixed standard G-suit pressure schedule might not necessarily be capable of providing adequate Anti-G protection for all subjects and even for the same subject at different time instances. The models developed in this paper can be used in an adaptive feedback control system for real-time identification and update of subjects' Anti-G protection requirements. Consequently, the G-suit pressures can be adjusted based on these models to provide most adequate Anti-G protections and compensate the variations in subject's physiological state.

Author

Models; Pressure Breathing; Pressure Suits; Real Time Operation; Computerized Simulation; Gravitational Effects; Acceleration Stresses (Physiology); Aerospace Medicine; Physiological Responses

20000032409 Dayton Univ., OH USA

Model Derived Timing Requirements for Gz Protection Methods

Rogers, Dana B., Dayton Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 22-1 - 22-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Studies of GLOC during Gz maneuvers highlight the need for further understanding of both orthostatic and transient behavior of blood pressure driven quantities in response to a variety of Gz profiles. Important in the analysis are duration, rates of change, direction and magnitude of transition and system memory (time at previous G level). The wide variety and number of profiles that need to be explored is intractable for human experimentation, indicating the need for functional models that provide a method for analyzing transient Gz equivalence under multiple profile conditions. The model used for this study uses a normalized set of Gillingham's data that is analyzed in a log amplitude and log frequency plot. The model is designed by the method of asymptotes for use in aircraft simulators.

Derived from text

Acceleration Stresses (Physiology); Models; Human Factors Engineering; Flight Crews; Computerized Simulation; Acceleration Tolerance

20000032412 Air Force Research Lab., Noise and Vibration Branch, Wright-Patterson AFB, OH USA

The Development of a Lumped-Parameter Model for Simulating the Vibration Response of the Human Body

Smith, S. D., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 25-1 - 25-11; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Seating systems provide a mechanism for minimizing the transmission of vehicle vibration to the occupant. Human vibration data has indicated that differences exist in the distribution of the mass, stiffness, and damping characteristics between the smaller female and larger male which may be important when designing seating systems. Mathematical models may provide a useful tool for the development and evaluation of seating systems for vibration mitigation. However, in order to be effective, these models must adequately simulate and predict the range of vibration response characteristics observed in the human body. A five degree-of-freedom (DOF) model was developed based on the dynamic response characteristics of major anatomical regions or structures

in the human body. The model was recently modified to represent the legs as a two DOF system based on vibration response data collected in this laboratory. This paper summarizes the development, modification, and effectiveness of the five DOF model in simulating the differences between representative female and male vibration responses. The model is also evaluated on its ability to predict the effects of seat cushions on human body vibration response.

Author

Human Body; Vibration; Biodynamics; Human Factors Engineering; Mathematical Models; Computerized Simulation; Occupational Diseases; Health

20000032688 Air Force Research Lab., HECF, Wright-Patterson AFB, OH USA

Pilot-Vehicle Interface

Calhoun, G. L., Air Force Research Lab., USA; Human Consequences of Agile Aircraft; March 2000, pp. 5 - 1 - 5 - 20; In English; See also 20000032683; Copyright Waived; Avail: CASI; A03, Hardcopy

Agile aircraft introduce new requirements and performance standards for the pilot-vehicle interface. This lecture will address these ergonomic issues as they pertain to agile aircraft. Specifically, controls and displays will be discussed, followed by design issues relevant to intelligent interfaces. The concepts and technologies proposed as candidate solutions for creating pilot-vehicle synergy are, for the most part, untested at present. It is hoped that this lecture will provide the impetus for the research required to realize a pilot-vehicle interface that will enhance the operation of agile aircraft, new capabilities, it is the multitude of systems that constitute agile aircraft that make the pilots' information management task the primary challenge and key determinant of successful deployment. Crew station design with the goal of pilot-cockpit synergy has the potential to provide the flexibility to maximum mission effectiveness.

Author

Human Factors Engineering; Flight Characteristics; Aircraft Pilots; Flight Fatigue; Flight Control; Display Devices; Flight Stress (Biology); Human-Computer Interface

20000033106 National Inst. for Occupational Safety and Health, Public Health Service, Pittsburgh, PA USA

Proposal for Certification Tests and Standards for Closed-Circuit Breathing Apparatus

Kyriazi, N.; Aug. 1999; 20p; In English

Report No.(s): PB2000-100638; NIOSH-IC-9449; DHHS/PUB/NIOSH-99-144; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Significant portions of the present Federal Regulations for certification of closed-circuit breathing apparatus (42 CFR 84) are not quantitative. The human-subject testing portion of the regulations specifies activities rather than metabolic work rates; however, heavy human subjects have higher oxygen consumption, CO₂ production, and ventilation rates than lighter human subjects performing the same activities. This means that apparatus certified using different human subjects have effectively passed different tests. In addition, apparatus performance is monitored only during selected intervals of testing, and always during rest, rather than during the entire performance period. Further, testing is arbitrary terminated at specific rated durations, leaving unknown the performance during the remaining duration. Duration itself is misleading to users who believe that the apparatus will last a certain time no matter how much they weigh or how hard they work. The actual duration obtained from an apparatus, however, is highly variable, being inversely proportional to the work rate at which it is used.

NTIS

Breathing Apparatus; Certification

20000033210 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan

A Study on Analyzing of Interaction Specification In User Interface Design

Ishiyama, Keitaro, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 421-422; In Japanese; Copyright; Avail: Issuing Activity

It is important to make sure of usability of a user interface to be designed, to do so, it is required that the designers analyze usability of the user interface in various aspects of a design process of efficient user interface. In this paper, from a viewpoint of user/task oriented method, we propose a method to analyze usability (consistency of interaction) of user interfaces based on the TID (Task-oriented Interaction Description) method which supports the interaction design of user interface.

Author

Human-Computer Interface; Computer Design

Subject Term Index

A

ABILITIES, 53
ABNORMALITIES, 38
ACCELERATION PROTECTION, 73
ACCELERATION STRESSES (PHYSIOLOGY), 42, 45, 46, 73
ACCELERATION TOLERANCE, 45, 46, 64, 73
ACCEPTABILITY, 66
ACCLIMATIZATION, 9
ACOUSTIC MEASUREMENT, 16
ACTIVITY (BIOLOGY), 1, 28
ACTIVITY CYCLES (BIOLOGY), 22, 43
ADAPTATION, 54, 61, 62
ADENOSINE TRIPHOSPHATE, 36
AERODYNAMIC FORCES, 71
AEROSPACE MEDICINE, 1, 3, 17, 18, 25, 31, 32, 37, 39, 40, 41, 42, 45, 52, 59, 68, 73
AEROSPACE SAFETY, 63
AGE FACTOR, 61
AIR BAG RESTRAINT DEVICES, 63
AIR POLLUTION, 39
AIRCRAFT ACCIDENTS, 17
AIRCRAFT MANEUVERS, 44, 45, 49
AIRCRAFT PILOTS, 49, 55, 57, 74
ALERTNESS, 37, 52, 59, 61
ALGAE, 6
ALTITUDE SICKNESS, 36
ALTITUDE SIMULATION, 55
AMINO ACIDS, 58
AMPHETAMINES, 52, 58
ANEMIAS, 26
ANIMALS, 49
ANTHROPOMETRY, 43, 68, 69
ANTI GRAVITY, 64
ANTIOXIDANTS, 42
ARRHYTHMIA, 22, 33
ARTERIES, 6, 7, 39
ARTIFICIAL INTELLIGENCE, 54, 68
ASTRONAUT PERFORMANCE, 23, 24
ASTRONAUT TRAINING, 53
ASTRONAUTS, 53, 63, 67
ATAXIA, 31
ATROPHY, 8, 26, 27, 28, 29
ATTITUDE (INCLINATION), 30, 31
AUTOMATIC CONTROL, 14
AUTONOMIC NERVOUS SYSTEM, 34

B

BARORECEPTORS, 73
BED REST, 41
BEES, 13
BEHAVIOR, 10
BENZENE, 39
BIOASTRONAUTICS, 1, 2, 3, 19, 20, 21, 24, 25, 26, 27, 28, 29, 31, 32, 33, 34
BIOCHEMISTRY, 8, 16, 17, 38, 61
BIODEGRADABILITY, 67
BIODEGRADATION, 12
BIODYNAMICS, 43, 46, 49, 63, 69, 70, 71, 72, 74
BIOENGINEERING, 64
BIOINSTRUMENTATION, 34
BIOLOGICAL EFFECTS, 18, 26, 31, 32, 33, 34, 47
BIOLOGICAL EVOLUTION, 5
BIOLOGICAL MODELS (MATHEMATICS), 24, 44, 69, 70, 71
BIOMASS, 8, 12, 14, 15
BIOREACTORS, 12
BIOSYNTHESIS, 6
BLAST LOADS, 49
BLASTS, 72
BLOOD, 17, 26, 39
BLOOD CELLS, 26
BLOOD CIRCULATION, 8, 35, 36
BLOOD FLOW, 19, 45
BLOOD PRESSURE, 3, 36, 37, 45
BLOOD VOLUME, 21
BODY TEMPERATURE, 52
BONE DEMINERALIZATION, 2, 18, 19, 33
BONE MINERAL CONTENT, 8
BONES, 2, 12, 18, 19, 70
BOTANY, 3
BRAIN CIRCULATION, 45
BRAIN DAMAGE, 9
BREATHING APPARATUS, 74
BREEDING (REPRODUCTION), 3
BRONCHI, 7
BURNS (INJURIES), 48

C

CAFFEINE, 53
CALCIUM, 27, 35
CAMOUFLAGE, 57

CANCER, 3, 31
CAPACITORS, 50
CARBON DIOXIDE, 13
CARBON MONOXIDE, 10, 17
CARBOXYHEMOGLOBIN, 17
CARCINOGENS, 3
CARDIAC VENTRICLES, 43
CARDIOVASCULAR SYSTEM, 3, 6, 12, 19, 20, 21, 22, 33, 34, 35, 37, 39, 41, 43, 44, 45, 62
CAROTID SINUS REFLEX, 3
CASUALTIES, 47, 48, 49
CATALYTIC ACTIVITY, 16
CELL DIVISION, 12
CELLS (BIOLOGY), 5, 7, 10, 27, 28, 35
CELLULOSE NITRATE, 4
CENTRAL NERVOUS SYSTEM, 60
CENTRAL NERVOUS SYSTEM STIMULANTS, 52
CEREBRUM, 7
CERTIFICATION, 74
CIRCADIAN RHYTHMS, 19, 22, 23, 24, 43, 53, 59
CIRCULATION, 42
CLAMPS, 36
CLINICAL MEDICINE, 37
COGNITION, 58
COMBAT, 48, 54
COMPUTER AIDED DESIGN, 67
COMPUTER DESIGN, 74
COMPUTER PROGRAMMING, 6
COMPUTER PROGRAMS, 14, 48, 52, 70
COMPUTERIZED SIMULATION, 5, 21, 37, 43, 45, 46, 47, 49, 51, 67, 69, 70, 71, 72, 73, 74
COMPUTERS, 14
CONDUCTIVE HEAT TRANSFER, 48
CONSUMABLES (SPACECREW SUPPLIES), 63
CONTINUUM MODELING, 5
CONTROL SYSTEMS DESIGN, 15
CONTROLLED ATMOSPHERES, 8
CONTROLLERS, 15
COUNTERMEASURES, 20, 27, 31, 52
CRASHES, 68, 70, 71, 72
CRASHWORTHINESS, 72
CREWS, 69, 71
CROP GROWTH, 12
CUFFS, 41
CULTIVATION, 8
CYANIDES, 17

CYTOLOGY, 26, 27

D

DAMAGE, 4
DATA ACQUISITION, 11
DATA BASES, 13, 43
DATA MANAGEMENT, 11
DATA PROCESSING, 45
DATA TRANSMISSION, 39
DECISION SUPPORT SYSTEMS, 16, 54
DECOMPRESSION SICKNESS, 36, 49
DECONDITIONING, 41
DEOXYRIBONUCLEIC ACID, 17, 25, 31, 32
DESIGN ANALYSIS, 64, 66, 71
DETECTION, 40, 56
DIASTOLIC PRESSURE, 50
DIGITAL SIMULATION, 39
DIGITAL SYSTEMS, 37
DIOXIDES, 38
DISEASES, 40
DISORIENTATION, 30, 55
DISPLAY DEVICES, 54, 74
DIURNAL VARIATIONS, 53
DIVING (UNDERWATER), 65
DOSAGE, 7
DOSIMETERS, 47
DROP TESTS, 70
DRUGS, 16, 52
DRYING, 12
DUMMIES, 70, 72
DYNAMIC CHARACTERISTICS, 51
DYNAMIC LOADS, 2
DYNAMIC MODELS, 71
DYNAMIC TESTS, 70

E

EJECTION INJURIES, 72
EJECTION SEATS, 71
ELASTIC PROPERTIES, 50
ELECTRIC STIMULI, 51
ELECTRICAL RESISTIVITY, 15
ELECTROCARDIOGRAPHY, 42
ELECTROLYTIC CELLS, 12
ELECTROMAGNETIC FIELDS, 52
ELECTROMAGNETIC RADIATION, 47
ELECTROMYOGRAPHY, 51
EMERGENCIES, 41
ENDOCRINE SYSTEMS, 21, 34
ENDOCRINOLOGY, 34

ENDOTHELIUM, 35
ENERGY TRANSFER, 41
ENVIRONMENT SIMULATION, 69
ENVIRONMENTAL CONTROL, 66
ENZYME ACTIVITY, 27, 36
ENZYMES, 27
EPITHELIUM, 7
EQUIPMENT SPECIFICATIONS, 64
ERRORS, 60
ERYTHROCYTES, 26, 36
ESCAPE SYSTEMS, 71, 72
ESTIMATING, 62
EVALUATION, 38
EXPERT SYSTEMS, 54
EXPLOSIVES, 49
EXPOSURE, 9
EXTRAVEHICULAR ACTIVITY, 65, 67
EXTRAVEHICULAR MOBILITY UNITS, 62
EYE (ANATOMY), 15, 36, 48
EYE MOVEMENTS, 29, 33

F

FABRICATION, 5, 17
FARM CROPS, 3, 12, 67
FATIGUE (BIOLOGY), 56, 59, 62
FEASIBILITY ANALYSIS, 8
FEMALES, 56, 68, 70
FERRIC IONS, 31
FINITE ELEMENT METHOD, 19, 44, 70, 72
FIRES, 17
FLIGHT CHARACTERISTICS, 49, 74
FLIGHT CONTROL, 74
FLIGHT CREWS, 40, 45, 46, 50, 56, 59, 73
FLIGHT FATIGUE, 49, 50, 57, 74
FLIGHT HAZARDS, 36
FLIGHT OPERATIONS, 50
FLIGHT SAFETY, 63
FLIGHT SIMULATION, 56, 57
FLIGHT STRESS (BIOLOGY), 50, 57, 74
FLUORESCENCE, 8
FOOD PRODUCTION (IN SPACE), 63
FREEZE DRYING, 67
FUNCTIONAL DESIGN SPECIFICATIONS, 62

G

GAMMA RAYS, 7
GAS EXCHANGE, 13

GENE EXPRESSION, 9, 43
GENETIC ENGINEERING, 4, 11
GENETICS, 11
GEOLOGICAL SURVEYS, 13
GRAVITATION, 15, 29, 66
GRAVITATIONAL EFFECTS, 1, 21, 29, 44, 45, 46, 49, 69, 73
GRAVITATIONAL PHYSIOLOGY, 1, 29, 45
GRAVITROPISM, 15
GREENHOUSES, 63
GROWTH, 8

H

HAZARDOUS MATERIALS, 35
HEAD (ANATOMY), 69, 72
HEAD DOWN TILT, 11, 35, 41
HEALTH, 6, 18, 46, 74
HEALTH PHYSICS, 3, 31
HEART, 3, 19, 20, 50
HEART FUNCTION, 9, 21, 34, 35, 44
HEART IMPLANTATION, 50
HEART RATE, 3, 40, 62
HEAVY IONS, 7, 32
HELMETS, 69
HEMODYNAMIC RESPONSES, 3, 7, 21, 22, 33, 35
HEMOGLOBIN, 38
HEREDITY, 9
HIGH ALTITUDE, 36
HIGH GRAVITY ENVIRONMENTS, 12, 64
HIGH PRESSURE OXYGEN, 35
HIGH TEMPERATURE, 36
HISTOLOGY, 6
HORMONES, 26, 38
HUMAN BEINGS, 47, 70
HUMAN BODY, 44, 52, 64, 68, 72, 74
HUMAN CENTRIFUGES, 49, 64
HUMAN FACTORS ENGINEERING, 16, 44, 45, 46, 49, 54, 56, 57, 65, 66, 67, 71, 73, 74
HUMAN PERFORMANCE, 22, 33, 46, 47, 48, 50, 54, 56, 58, 61, 64, 65
HUMAN REACTIONS, 34
HUMAN RESOURCES, 18
HUMAN TOLERANCES, 46, 68, 70
HUMAN-COMPUTER INTERFACE, 57, 74
HYDRAZINES, 35
HYPNOSIS, 52
HYPOBARIC ATMOSPHERES, 4
HYPOKINESIA, 11
HYPOTHERMIA, 8

HYPOXIA, 4, 8, 9, 55

I

IMAGE PROCESSING, 15
IMAGING TECHNIQUES, 37
IMMOBILIZATION, 11
IMMUNE SYSTEMS, 1
IMMUNITY, 24
IMMUNOLOGY, 24
IMPACT ACCELERATION, 43, 69, 72
IMPACT LOADS, 70
IMPACT TESTS, 43, 70, 72
IMPLANTATION, 5
IN-FLIGHT MONITORING, 24, 25
INERTIA, 60
INFECTIOUS DISEASES, 25, 34
INFORMATION DISSEMINATION, 43
INJURIES, 47, 48, 49, 68, 69, 70, 72
INSECTS, 15
INTERNAL ENERGY, 38
INTERVALS, 42
INTRAVEHICULAR ACTIVITY, 41
INVENTIONS, 6, 65
IONIZATION, 39
IRRADIATION, 7

J

JET LAG, 61

K

KIDNEYS, 21

L

LASER PLASMAS, 17
LENSES, 36
LIFE SUPPORT SYSTEMS, 12, 62, 65, 66
LIQUID CHROMATOGRAPHY, 39
LIQUIDS, 16
LIVER, 12
LOCOMOTION, 31
LOW CONCENTRATIONS, 10
LOW FREQUENCIES, 52
LOWER BODY NEGATIVE PRESSURE, 21, 37, 38
LUNGS, 4
LYMAN ALPHA RADIATION, 17
LYMPHOCYTES, 1

M

MALES, 55, 56, 68
MAMMARY GLANDS, 3, 31
MANNED MARS MISSIONS, 53, 62
MARINE BIOLOGY, 6
MARS (PLANET), 53, 62
MARS EXPLORATION, 53, 62
MARS SURFACE, 53, 62
MASS, 66
MASS SPECTROSCOPY, 39
MATHEMATICAL MODELS, 2, 15, 21, 36, 45, 46, 47, 48, 49, 51, 70, 71, 72, 74
MECHANICAL PROPERTIES, 67
MECHANICAL SHOCK, 46
MEDICAL SCIENCE, 4
MEDICAL SERVICES, 18, 37
MEMBRANE STRUCTURES, 5
MEMORY, 55
MENTAL PERFORMANCE, 22, 23, 24, 50, 56, 61
METABOLISM, 4, 23
METABOLITES, 39
MICROBIOLOGY, 25, 26
MICROGRAVITY, 2, 3, 10, 12, 15, 18, 19, 20, 21, 22, 26, 27, 28, 29, 31, 33, 36
MICROORGANISMS, 25
MIGRATION, 13
MILITARY OPERATIONS, 37, 53, 58, 59, 60, 61
MILLET, 9
MINERALS, 13, 14, 15
MINING, 11
MISSION PLANNING, 53
MODAL RESPONSE, 70
MODELS, 45, 46, 49, 73
MORPHOLOGY, 8
MOTION SICKNESS, 11, 46
MOTOR VEHICLES, 63, 65
MUSCLES, 8, 26, 27, 28, 29, 35, 68
MUSCULAR FUNCTION, 8
MUSCULOSKELETAL SYSTEM, 2, 8, 19, 27, 28, 29, 51
MUTAGENS, 3
MUTATIONS, 3, 6
MYOGLOBIN, 38

N

NECK (ANATOMY), 69, 70, 72
NEOPLASMS, 3
NETWORK ANALYSIS, 66
NEURAL NETS, 52, 68

NEUROMUSCULAR TRANSMISSION, 29
NEURONS, 29
NEUROPHYSIOLOGY, 23, 29, 34, 73
NITROGEN COMPOUNDS, 16
NITROGEN OXIDES, 35
NOISE (SOUND), 36
NONLINEARITY, 16
NORTH AMERICA, 13
NUTRITION, 13

O

OCCUPATIONAL DISEASES, 46, 74
OILS, 67
OPERATIONAL HAZARDS, 46
OPTIMIZATION, 66
ORGANIC COMPOUNDS, 12
ORGANIC MATERIALS, 5
ORGANIC PHOSPHORUS COMPOUNDS, 58
ORTHOSTATIC TOLERANCE, 21
OSTEOPOROSIS, 18
OVENS, 12

P

PARACHUTE DESCENT, 38
PARALYSIS, 51
PATENTS, 6, 65
PATHOLOGY, 38, 49
PATIENTS, 18
PATTERN RECOGNITION, 56
PERCEPTION, 55
PERCEPTUAL ERRORS, 30
PERFORMANCE PREDICTION, 54, 67
PERFORMANCE TESTS, 55
PERSONAL COMPUTERS, 69
PERSONALITY, 56
PERSONNEL, 52, 58, 60, 61, 62
PH, 14
PHARMACOLOGY, 11, 27
PHENOLS, 42
PHOTOGRAPHS, 57
PHOTONS, 31
PHOTORECEPTORS, 15
PHOTOSYNTHESIS, 13
PHYSICAL EXERCISE, 2, 4, 20
PHYSIOLOGICAL EFFECTS, 1, 3, 18, 24, 31, 32, 33, 34, 35, 49, 50
PHYSIOLOGICAL RESPONSES, 1, 3, 11, 21, 23, 24, 34, 35, 37, 43, 44, 45, 49, 54, 69, 71, 73
PHYSIOLOGICAL TESTS, 19, 57

PHYSIOLOGY, 20, 23, 24, 26, 33, 38, 41, 64
 PHYTOPLANKTON, 6
 PILOT PERFORMANCE, 49, 57
 PILOT SELECTION, 57
 PILOT TRAINING, 57
 PLANTS (BOTANY), 3, 10
 PLASMA CHEMISTRY, 38
 POPULATIONS, 6, 60
 POSITION (LOCATION), 56
 POSTURE, 31
 POTATOES, 13, 14, 15
 POWER SUPPLIES, 50
 PREDICTIONS, 48
 PRESERVING, 67
 PRESSURE BREATHING, 45, 73
 PRESSURE PULSES, 39
 PRESSURE REDUCTION, 65
 PRESSURE SUITS, 45, 64, 73
 PREVENTION, 3
 PROBABILITY THEORY, 36
 PROCEDURES, 5, 66
 PRODUCT DEVELOPMENT, 17
 PRODUCTIVITY, 62
 PROSTAGLANDINS, 38
 PROTECTION, 35, 48, 72
 PROTECTIVE CLOTHING, 44
 PROTEINS, 4, 9, 12, 26, 27, 28, 67
 PROTOBIOLOGY, 5
 PSYCHOLOGICAL EFFECTS, 54
 PSYCHOMOTOR PERFORMANCE, 23, 24
 PULMONARY CIRCULATION, 36
 PYROTECHNICS, 48

Q

QUALIFICATIONS, 53
 QUANTITATIVE ANALYSIS, 68

R

RADIATION DAMAGE, 31, 48
 RADIATION DOSAGE, 32, 47, 48
 RADIATION EFFECTS, 3, 31, 32
 RADIATION INJURIES, 31, 48
 RADIOBIOLOGY, 17
 RAPID EYE MOVEMENT STATE, 51
 RATS, 8, 9
 REACTION TIME, 55
 REAL TIME OPERATION, 15, 54, 73
 RECORDS, 60
 REFLEXES, 29

RELATIVE BIOLOGICAL EFFECTIVENESS (RBE), 3, 7, 32
 RENAL FUNCTION, 21
 REPLENISHMENT, 13, 15
 RESEARCH, 39
 RESEARCH AND DEVELOPMENT, 37
 RESEARCH MANAGEMENT, 4, 18
 RESPIRATION, 4
 RESPIRATORY PHYSIOLOGY, 42
 RESPIRATORY SYSTEM, 42
 REUSE, 12
 RHYTHM (BIOLOGY), 16
 ROCKET PROPELLANTS, 35
 ROTATION, 11

S

SAFETY, 35
 SAFETY DEVICES, 44, 63, 72
 SAFETY FACTORS, 71
 SAFETY MANAGEMENT, 72
 SANITATION, 35
 SCALE MODELS, 72
 SEATS, 70, 72
 SEEDS, 9
 SENSORY PERCEPTION, 55
 SERIES EXPANSION, 6
 SERUMS, 8
 SEX FACTOR, 61
 SHOES, 65
 SIGNAL MEASUREMENT, 50, 51
 SIGNAL PROCESSING, 51
 SIGNS AND SYMPTOMS, 60, 61
 SIMULATION, 21, 44, 64
 SKIN (ANATOMY), 48
 SLEEP, 16, 22, 23, 24, 34, 37, 51, 52, 53, 58, 59, 60, 62
 SLEEP DEPRIVATION, 19, 20, 23, 24, 33, 34, 53, 58, 60, 61, 62
 SOCKS, 65
 SOFTNESS, 5
 SOILS, 12
 SPACE FLIGHT, 3
 SPACE MISSIONS, 13
 SPACE PERCEPTION, 57
 SPACE SUITS, 41, 63, 64, 65, 66
 SPACEBORNE EXPERIMENTS, 15
 SPACECRAFT LANDING, 41
 SPATIAL DISTRIBUTION, 55
 SPECIFICATIONS, 64
 SPINE, 69
 SPLEEN, 1
 STABILITY, 31
 STATISTICAL ANALYSIS, 13
 STEREOSCOPIC VISION, 57

STIMULATION, 4, 12, 51
 STRAIN RATE, 70
 STRESS (BIOLOGY), 61
 STRESS (PHYSIOLOGY), 44, 51
 STRESS (PSYCHOLOGY), 51
 STRESS ANALYSIS, 57
 SURFACE REACTIONS, 16
 SURFACE ROUGHNESS, 5
 SURFACE WATER, 13
 SYNCHRONISM, 52
 SYSTEM IDENTIFICATION, 51
 SYSTEMS INTEGRATION, 68
 SYSTOLIC PRESSURE, 37

T

TACHYCARDIA, 22
 TARGET ACQUISITION, 57
 TARGET RECOGNITION, 56, 57
 TASK COMPLEXITY, 65
 TEA LASERS, 42
 TECHNOLOGY ASSESSMENT, 5, 63, 66
 TECHNOLOGY UTILIZATION, 39, 68
 TELEMEDICINE, 37, 39
 TEMPERATURE CONTROL, 12, 65
 TEMPERATURE EFFECTS, 36
 TEMPERATURE MEASUREMENT, 41
 THERMAL ANALYSIS, 41
 THERMAL SHOCK, 9
 THERMODYNAMICS, 38
 THERMOREGULATION, 52
 THIN FILMS, 5
 TISSUES (BIOLOGY), 5, 6, 16
 TOMOGRAPHY, 68
 TORQUE, 71
 TOXIC HAZARDS, 35
 TOXICITY, 17, 35
 TOXICOLOGY, 17, 35
 TRANSFORMATIONS (MATHEMATICS), 13
 TROPISM, 15
 TUMORS, 3
 TYROSINE, 58

U

UH-1 HELICOPTER, 55
 UH-60A HELICOPTER, 55
 ULTRASONICS, 16, 37, 50
 UNCONSCIOUSNESS, 40
 UNDERWATER BREATHING APPARATUS, 65
 UNDERWATER PHYSIOLOGY, 65

UNIVERSITY PROGRAM, 1
UROLOGY, 39

V

VARIABILITY, 40
VARIATIONS, 9
VASOCONSTRICTOR DRUGS, 38
VEGETATION GROWTH, 8, 14, 15, 63
VERBAL COMMUNICATION, 55
VERTEBRAE, 68
VERTICAL PERCEPTION, 30
VESTIBULES, 40
VIBRATION, 42, 74
VIBRATION MEASUREMENT, 50
VIRAL DISEASES, 25
VIRTUAL REALITY, 55
VIRUSES, 25
VISUAL ACUITY, 31
VISUAL DISCRIMINATION, 57
VISUAL OBSERVATION, 56, 57
VISUAL PERCEPTION, 18, 30, 56
VISUAL STIMULI, 30

W

WAKEFULNESS, 24, 58, 59, 61
WALLS, 7
WARFARE, 47
WATER TUNNEL TESTS, 72
WEIGHTLESSNESS, 1, 18, 19, 26, 27
WEIGHTLESSNESS SIMULATION, 6,
7, 8, 35, 36, 38

X

X RAY SOURCES, 17

Personal Author Index

A

Abarbanel, Henry, 11
Aglan, H., 14, 67
Alaways, LeRoy, 56
Albano, J. P., 46
Albery, W., 49, 57
Alfrey, Clarence P., 25
Aljundi, B., 72
Allen, Gary L., 54
Anand, Inder, 43
Anderson, Beth, 68
Arendt, Josephine, 53
Argyros, Greg, 48
Arizzi, Rocco Vincent, 62
Arrhenius, G., 15
Askari, V., 45, 73
Axley, Milton J., 65

B

Bai, Jing, 39
Balestra, V., 60
Ballevre, O., 53
Banks, Bruce A., 5
Banks, R. D., 49
Bao-hua, Wang, 38
Barricklow, Paul, 62
Barton, George, 62
Bass, C. R., 70
Batejat, D., 53
Batejat, Denise, 60
Beaumont, M., 53
Beaumont, Maurice, 60
Bedewi, Paul G., 72
Beelke, M., 60
Behdinan, K., 44
Bennett, Phillip, 62
Bertini, Mario, 60
Billingsley, John, 54
Blaszkevicz, Meinolf, 52, 61
Bles, W., 46, 49
Bloomfield, Susan A., 18
Bomar, John B., Jr., 69
Bos, J. E., 46
Bosah, Francis N., 12
Braithwaite, Malcolm G., 55
Brown, Emery N., 24
Buhrman, John R., 43
Burbank, Daniel C., 53
Burton, Russell R., 46

Butel, Janet S., 24

C

Cai, Qing, 9
Caldwell, J. Lynn, 61
Caldwell, John A., 52
Calhoun, G. L., 74
Callan, Curtis, 11
Cameron, B. J., 46
Canfield, Dennis V., 17
Cantrell, John H., 5
Cao, Xin-sheng, 38
Cao, Zin-sheng, 34
Carver, B., 47
Casagrande, Maria, 59, 60, 61
Catrycke, Marc, 60
Chan, Philemon C., 71
Chang, Shao-Yong, 41
Chaturvedi, Arvind K., 17
Chauffard, F., 53
Chen, Jin-dun, 63
Chen, Jing-Shan, 66
Chen, Jing-shan, 64
Chen, Sheng, 38
Chen, Tong-Xin, 9
Chen, You-Chun, 9
Chipot, Christophe, 5
Chu, Xu, 64
Cirovic, S., 43, 44
Clare, Sharron, 62
Co, Elizabeth L., 49
Cohen, Richard, 20
Cohen, Richard J., 21, 32
Conklin, A., 48
Cordelli, A., 60
Cornelissen, Germaine, 43
Coursen, Garth Edward, 62
Cox, Akio, 62
Crandall, J. R., 70
Crawford, Kamau, 11, 12
Cui, Wei, 8
Czeisler, Charles A., 22

D

Dally, William, 11
Davis, D., 14
Davis, Edward G., 47
DeCarli, F., 60
DeFlores, Lauren, 62

Degen, Gisela, 52, 61
DeGennaro, Luigi, 60
Deijen, J. Berend, 58
Dicello, John F., 31
DiCuccio, M., 68
Diehl, Alison, 62
Digges, Kennerly H., 72
Dijk, Derk-Jan, 23, 33
Dinges, David F., 23
Dischinger, H. Charles, Jr., 67
Dogan, N., 14
Doireau, P., 53
Dong, Qi, 8
Dowdy, M. W., 63
Du, Jian-ying, 55
Duma, S. M., 70
Dyson, Freeman, 11

E

Ebbeler, D. H., 63
Enslin, M., 53
Eom, Gwang-Moon, 51
Eppler, Dean, 53
Epstein, Henry F., 27
Eriksson, M., 56
Estrada, Arthur, 55

F

Feng, Lin-hua, 37
Ferrara, Michele, 59, 60, 61
Ferrillo, F., 60
Forbes, Jacob Edward, 62
Fox, George E., 25
Fraser, W. D., 43, 44, 45, 72, 73
French, Jonathan, 60
Fukumoto, Takenori, 51
Fulford, J., 16
Furuse, Norio, 51

G

Gao, Jian-Yi, 10
Garbarino, S., 60
Garber, Ari, 62
Garrison, Robert, 53
Geng, Xi-chen, 64
Goldberg, Alfred, 26
Goldsmith, Randall, 62
Golka, Klaus, 52, 61

Goodhead, D. T., 16
 Gowdy, V., 72
 Grau, J. Y., 57
 Green, P., 65
 Gregory, Kevin B., 49
 Griefahn, Barbara, 52, 61
 Guo, Li-Ying, 40
 Guo, Shuang-sheng, 7
 Guo, Zeng-Yuan, 66
 Guo, Zhi-Feng, 10

H

Haenlein, Joel, 62
 Halberg, Franz, 43
 Hall, Robert W., 65
 Hamilton, Casey, 13
 Hamilton, Susan L., 27
 Hao, Ai-gong, 4
 Hao, Wei-wei, 36
 Hao, Wei-ya, 34, 37
 Happee, R., 70
 Harris-Hooker, Sandra A., 12
 Harvey, Ralph, 53
 He, Ping, 38
 Heath, Cleveland A., 65
 Hernandez, Paul, Jr., 62
 Hileman, Douglas R., 13
 Hill, Jill, 13
 Hill, M. A., 16
 Ho, Kevin H., 48
 Hoffman, Paul, 53
 Hoffman, Siobhan M., 55
 Hoofman, M. L. C., 69
 Hu, P., 39
 Hu, Ping, 1
 Hu, Wen-xiang, 35
 Hu, Yong-Hun, 41
 Huang, Bin, 1
 Hudlicka, Eva, 54
 Hurt, William D., 47
 Huso, David L., 3

I

Ishiyama, Keitaro, 74

J

Jackson, Andrew C., 42
 Jernajczyk, Wojciech, 59
 Ji, Gui-Ying, 9
 Jia, Si-Guang, 66
 Jia, Si-guang, 64
 Jiang, Chang-lin, 38

Jiang, Guo-Yong, 9
 Jiang, Jian, 35
 Jiang, Shi-Zhong, 41
 Jiang, Shi-zhong, 38
 Jiang, Xing-Cun, 9
 Jiang, Xing-cun, 3
 Jiao, Shu-Jin, 41
 Johnson, Julie M., 49
 Johnson, Mark A., 68
 Johnson-Dunnings, H., 55
 Jones, G., 67
 Jones, Thomas, 53
 Joyce, Gerald F., 11

K

Kamm, Roger D., 21
 Kan, Guang-Han, 40
 Kannan, N., 49
 Kapps, A., 45, 73
 Kaur, S. S., 56
 Kayar, Susan R., 65
 Kern, Volker, 15
 Kim, E.-H., 63
 Klopčič, J. Terrence, 47
 Knox, F. S., 48
 Kodounis, Antonios, 52
 Kong, An., 39
 Kuenemund, Christa, 52, 61
 Kyriazi, N., 74

L

Lagarde, D., 53
 LaGarde, Didier, 58
 Lagarde, Didier, 60
 Lau, Wai M., 51
 Lawless, Nancy, 48
 Lawton, B., 48
 LeDuc, Patricia A., 55
 Lee, Brett, 62
 Lei, Liu, 35
 Leng, Shun-tang, 38
 Li, Bin, 35
 Li, Jian-Jun, 41
 Li, Jin-gou, 3
 Li, Jin-Guo, 9
 Li, ming-gao, 36
 Li, She-Rong, 10
 Li, Tong, 4
 Li, Wei-Gang, 39
 Li, Xue-yi, 55
 Liang, Hong, 10
 Liang, Xin-Gang, 66
 Lin, Shi-long, 35

Linder, Jan, 57
 Littlefield, Richard J., 37
 Liu, Hong-Jin, 9
 Liu, Hua-Feng, 40
 Liu, Jing-chang, 35
 Liu, Lei-hua, 7
 Liu, Min, 10
 Liu, Xin-Min, 11
 Liu, Xing-Hua, 42
 Liu, Zhi-Qiang, 40
 Long, Chao-liang, 9
 Loretan, P., 14
 Loughhead, Tomas E., 67
 Love, Felisha D., 12
 Lu, J., 67
 Lu, Sheng-Qiang, 42
 Lu, Xia, 64
 Lu, Xing-qiang, 9
 Lu, Xiu-qin, 7
 Lu, Z., 45, 73
 Luo, Xin-Min, 41

M

Ma, Deren, 70, 71
 Ma, Gui-xi, 36
 Ma, Jin, 6, 7
 Ma, Yong-lie, 8
 Mack, Alison B., 65
 Maksymiuk, Grzegorz, 59
 Manning, J. E., 70
 Mao, Qin-wen, 7
 Martin, S. H., 46
 Masiello, Paul J., 48
 Mason, Patrick A., 47
 Mathews, Saemi, 62
 Mayorga, Maria A., 48
 Mei, Dan, 8
 Melhado, Caroline D., 12
 Melikian, A. A., 39
 Meng, M., 39
 Meng, Qing-jun, 36
 Merrifield, R., 48
 Middleton, Benita, 53
 Miller, R. E., II, 47
 Mitchell, Jonathan, 62
 Moore, N. R., 63
 Morrison, J. B., 46
 Mortley, D., 14
 Mortley, Desmond G., 13
 Mosier, Dennis R., 28
 Moya, John A., 15
 Mullen, Thomas J., 33
 Mullington, Janet M., 34
 Muniz, Margarita, 13

N

Nakamura, Kazuhiro, 50
Nakaya, Shigemitsu, 50
Neades, David N., 47
Neiley, Roger T., 65
New, Michael H., 5
Ni, Cheng-zhi, 4
Nicol, J. J., 46
Nobili, L., 60
Nottola, A., 16
Ntuen, C., 55

O

O, 39
Obergefell, Louise, 68, 70
Obergefell, Louise A., 71
OMalley, Bert W., 18
Oman, Charles M., 30
ONeill, P., 16
Opstad, Per Kristian, 61

P

Pancratz, David J., 69
Papanikolopoulos, N. P., 56
Paskoff, G., 68
Patrick, N., 67
Pei, Jing-Chen, 39, 40
Pellettiere, J. A., 70
Perry, C. E., 48
Perry, Chris, 68
Petropoulos, L. J., 49
Phen, R. L., 63
Pilmanis, A. A., 49
Pohorille, Andrew, 5
Porcu, Silvio, 59, 60, 61
Portalatin, M., 55

Q

Qian, Jin-Kang, 10
Qin, Shi-zhen, 36
Qiu, Man, 41

R

Ramsdell, Craig D., 33
Ren, Jian-Xun, 66
Ren, Wei, 36
Reynolds, D. B., 48
Rhodes, David, 6
Ribeiro, Nuno Pedro, 59
Rizer, Annette, 70

Rizer, Annette L., 71
Robinson, D. G., 46
Roddan, G., 46
Rogers, Dana B., 73
Rogers, Lawrence C., 71
Rosekind, Mark R., 49
Rosenthal, Nadia A., 28
Ruff, Christopher B., 19
Rutledge, Sharon K., 5

S

Sack, Fred D., 15
Sanchez, Merri J., 66
Sanders, Peter, 51
Sanford, Gary L., 12
Schmitt, Harrison, 53
Schultheis, Lester W., 1
Schwartz, Robert J., 26
Schweighofer, Karl, 5
Schweitzer, M., 68
Shaikh, W., 16
Shang, Wei-Fen, 11
Shearer, William T., 24
Shelhamer, Mark J., 29
Shen, Li-ping, 65
Shen, Xian-yun, 8
Shi, He-ping, 63
Shi, Hong-Zhi, 10
Shoukas, Artin A., 2
Sicard, B., 53
Simons, M., 37, 59
Sinden, Richard R., 32
Smith, B., 14
Smith, Dudley R., 17
Smith, S. D., 73
Song, Jie, 11
Springer, M.-J.-N., 46
Stevens, D. L., 16
Stone, Barbara, 53
Stone, Barbara M., 58
Strayer, Richard, 12
Strickland, D., 55
Stuhmiller, James H., 48, 71
Sun, Hai-long, 63
Sun, Jin-biao, 63
Sun, Kui, 8
Sun, Lei, 36
Sun, Shao-Mei, 11
Sun, Xi-Qing, 40, 41
Sun, Xi-qing, 34, 37, 38
Sun, Xing-bin, 9
Sun, Ya-zhi, 8
Suzuki, Tsunehisa, 16

T

Tabarroch, B., 44
Tachon, P., 53
TalEr, George A., 5
Tallents, G. J., 16
Tan, Chong-yang, 35
Tan, Sheng-jian, 35
Tanguay, Robert M., 38
Terse, Anita, 13
Teulings, A. M. G. L., 72
Their, Ricarda, 52, 61
Thompson, S. M., 39
Tielemans, W., 57
Torres, Charly, 63
Trotman, Audrey, 11
Tsimhoni, O., 65
Turcu, E., 16

V

Valk, P. J., 37
Valk, P. J. L., 59
VanBeers, Pascal, 60
Vandenbergh, Loretta L., 6
vandenKroonenberg, A. J., 69
vanderHorst, M. J., 69
VanZandt, T. R., 63
Vargas, Gabriel, 13
Varoneckas, G., 62
Vullings, Huub F. M., 58

W

Wall, Conrad., III, 30
Walsh, C., 43, 44
Walsh, Michael James, 63
Wan, Chang-hong, 4
Wan, Chao-min, 43
Wang, Bao-Zhen, 10
Wang, De-sheng, 36
Wang, Hai, 9
Wang, Hong, 41
Wang, Jing, 10
Wang, Li-hua, 8
Wang, Ling, 43
Wang, Pei-Sheng, 9
Wang, Pei-sheng, 3
Wang, Tao, 8, 55
Wang, Xian-Min, 41
Wang, Xian-min, 38
Wang, Ya-Lin, 10
Wang, Zheng-rong, 43
Wang-Sheng-Ping, 11
Watanabe, Hiroyuki, 50

Watkins, Wendell R., 56
 Wedel, Dale, 63
 Wei, Ying-bo, 34
 Welsch, H., 49
 Wen, Ji-Fu, 41
 Wen, Xiu-lan, 1
 Westhall, J., 16
 Wharton, R. K., 48
 Whitley, P., 68
 Wientjes, Cornelis J. E., 58
 Williams, Gordon, 19
 Williams, Gordon H., 20
 Williams, Jerry R., 31
 Wilson, Michael A., 5
 Wismans, J. S. H. M., 69, 72
 Wolfe, Jeremy M., 56
 Wright, S., 55
 Wu, Bin, 42
 Wu, Jian-Min, 41
 Wu, Qing-Cai, 41
 Wu, Qing-cai, 38
 Wu, Tang-chun, 38
 Wu, Xin-Yu, 41
 Wu, Xing-Yu, 40
 Wu, Xing-yu, 34, 37, 38, 55
 Wu, Zhi-qiang, 65

X

Xi, Bao-shu, 39

Xiang-Qui-lu, 36
 Xie, Bao-Sheng, 42
 Xin, Yi-mei, 4
 Xiong, Yi-li, 38
 Xu, Bin, 8
 Xu, Bo, 7
 Xu, Qing-Yuan, 41
 Xu, Xian-Rong, 40
 Xue, Huai, 10
 Xue, Yue-Ying, 42

Y

Yan, Gui-ding, 64
 Yan, Xiao-Xia, 39
 Yang, Guang-hua, 8
 Yang, Hong-hui, 8
 Yang, Mei-ying, 7
 Yang, Tian-De, 41
 Yang, Tian-de, 6
 Yao, Jong-jie, 37
 Yao, Yong-Jie, 40, 41
 Yao, Yong-jie, 34, 38
 Ye, Chang-qing, 7
 Yin, Zhao-yun, 9
 Yoo, H., 65
 Yost, William T., 5
 You, Guang-Xing, 42
 Young, Laurence R., 54

Yu, James H.-Y., 71
 Yu, Jie, 41
 Yu, Qi-fu, 36
 Yu, Shu-Ren, 11
 Yu, Xue-Jun, 41
 Yuan, Xiong, 7
 Yuan, Xiu-gan, 65

Z

Zhan, Chang-lu, 64
 Zhan, Hao, 4, 41
 Zhang, Chun-Hua, 10
 Zhang, Hong, 1
 Zhang, Jian, 3, 9
 Zhang, Ju-peng, 39
 Zhang, Le-ning, 6, 7
 Zhang, Li-fan, 6, 7, 37
 Zhang, Qing-jun, 4
 Zhang, Wei, 8
 Zhang, Wu-xing, 64
 Zhang, Xin-Rong, 66
 Zhao, Hong, 36
 Zhao, Min, 35
 Zhou, Zhi, 9
 Zhuang, Yong, 55
 Ziejewski, Mariusz, 68
 Zu, Pei-zhen, 39

Report Documentation Page

1. Report No. NASA/SP—2000-7011/SUPPL499	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Aerospace Medicine and Biology A Continuing Bibliography (Supplement 499)		5. Report Date April 2000	
		6. Performing Organization Code	
7. Author(s)		8. Performing Organization Report No.	
9. Performing Organization Name and Address NASA Scientific and Technical Information Program Office		10. Work Unit No.	
		11. Contract or Grant No.	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Langley Research Center Hampton, VA 23681		13. Type of Report and Period Covered Special Publication	
		14. Sponsoring Agency Code	
15. Supplementary Notes			
16. Abstract This report lists reports, articles and other documents recently announced in the NASA STI Database.			
17. Key Words (Suggested by Author(s)) Aerospace Medicine Bibliographies Biological Effects		18. Distribution Statement Unclassified – Unlimited Subject Category – 52	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 98	22. Price